ENVIRONMENTAL ASSESSMENT

CACAO CROP ALTERNATIVE DEVELOPMENT PROJECT IN SUR DE BOLIVAR AND NORTE DE SANTANDER (TIBU), COLOMBIA

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FINAL REPORT

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SECTION 1 EXECUTIVE SUMMARY

1.1 INTRODUCTION

1.1.1 Background

One of the thematic areas operated by the PNDA [Colombian National Alternative Development Program] is the Preservation and Improvement of Natural Resources and the Environment in areas where illicit crop substitution activities are undertaken. USAID and the Government of Colombia are seeking to have the implementation of these programs generate the least possible negative impact on the environment or no impact at all.

1.1.2 Objective

The main purpose of the environmental assessment is performing an assessment of the physical, biotic and social and economic aspects in the area influenced by the Cacao cultivation project, including an analysis of alternatives where a no-action option is included, the identification and evaluation of the potential impacts caused by the implementation and operation of the project, and ultimately determining the Environmental Management and Monitoring Plans, with its measures, that need to be adopted to ensure the sustainable development of the project in the long term.

1.2 DESCRIPTION OF THE PROJECT

1.2.1 Location and Scope

The project is underway in the municipality of Tibú, Department of Santander del Norte, and in southern areas of the Bolivar Department, in the municipalities of Río Viejo, Simití, Santa Rosa del Sur, San Pablo, Arenal, Morales and Cantagallo.

The goal of the project is to establish 1,500 hectares of Cacao in Tibú, Norte de Santander and 1,600 hectares in seven southern municipalities of Bolívar. For the latter region, the project has organized two stages: the current stage in which 22 Cacao plots of 1 hectare each (2.47 acres) have been planted, and a subsequent second stage in which 1,600 hectares will be planted.

The project seeks to consolidate this agricultural and forestry line as well as that of plantain (as an associated crop) by including a food security model consisting of a maize–bean association, as part of a proposal that is an alternative production, sustainable, profitable, improves the ecosystem, has a regional tradition and contributes to counteract the expansion of illicit coca cultivation. It should also raise the standard of living and help recover the self-respect of growers in these municipalities.

The direct benefits created by the project are as follows:

- Five hundred small-scale Cacao growers will benefit directly from activities geared at establishing and consolidating the Family Productive Unit, which for technical Cacao production is estimated at 3 hectares (7.41 acres). Two thousand regional Cacao-growing families will benefit indirectly (a total of approximately 10,000 persons).

- Approximately 496,960 daily wages will be generated over the course of three years, as follows: 245,960 the first year, 143,500 the second year and 107,500 the third year.

1.2.2 Project Activities

Following are the specific activities of the Cacao cultivation project that have each received an environmental assessment:

- Production of sowing material (nursery)
- Pest, disease and weed control
- Fertilization
- Agroforestry
- Renewal of old plantations
- Benefits process
- Food Security
- Commercial logistics
- Accompaniment

1.3 REGIONAL DESCRIPTION – Alternatives Analysis

The environmental assessments cover two different regions, each with a direct and an indirect area of influence. The direct areas of influence are the project's cultivation plots plus a 100 meter radius extension around these. The indirect area of influence expands to the municipalities where the projects are located, along the main river basins and where the more general ecological concerns arise.

Both areas of influence have well-defined boundaries: the indirect area of influence of includes the southern Bolivar Department, in the municipalities of Arenal, Cantagallo, Morales, Río Viejo, San Pablo, Santa Rosa Sur and Simití, some of which are located on the Magdalena River basin.

The second area of indirect influence is limited to the Municipality of Tibú in the Department of Santander del Norte; the direct area of influence encompasses four *veredas* (submunicipal divisions), namely: Tibú itself, Campo Dos, La Pacelli and La Gabarra.

An Analysis of Alternatives includes two main options: the development or not of the project. The Analysis has shown that the current use of natural resources and the given state of the environment, would mean that in very few years the deforestation, increased use of pesticides, illegal armed groups operating in the area with a very possible impact on small scale land tenure, would be a very negative alternative. This means that a no-action option is not desirable at the moment, so then, if the project develops and applies the Environmental Management Plan proposed, a significant environmental and social improvement would be visible in the near future. A detailed analysis is presented within the document.

1.3.1 Location

The municipality of Tibú is located at 8º 38´53´´ latitude North and 72º44´22´´ longitude East at an altitude of 47 to 1,400 meters and at a distance of 109 km from Cúcuta, the capital of Santander del Norte.

The project's crops in Bolívar are located in the middle Magdalena River Valley (in the southern part of the Department) between the left bank of the Magdalena River and the Serranía de San Lucas and comprises the municipalities of Simití, Santa Rosa del Sur, San Pablo, Cantagallo, Río Viejo, Morales and Arenal.

1.3.2 Climate

The Municipality of Tibú is included in the Humid Tropical Forest and Very Humid Tropical Forest agro-ecological zones, with 2,500 to 3,500 mm rainfall per year, an average temperature of 30°C (86° F) and 75% to 85% relative humidity.

The southern region of Bolívar has an average temperature of 25° to 36° Celsius (77° to 97° F), annual rainfall between 1,500 and 2,000 mm and a relative humidity of 70% - 80%.

1.3.3 Biotic Characteristics

The prevailing Life Zone for a Cacao project, according to the classification developed by Leslie Holdridge, is the Humid Tropical Forest --a zone that in Colombia is greatly affected by human activities, to the point that some species are threatened with extinction (Rangel O., 1987). However, the various habitats facilitate the presence of a wide range of species, specifically wild fauna associated with aquatic ecosystems such as swamps and wetlands. That is why it is easy to find manatees, capybara (Hydrochaeris hidrochaeris), sub-adult crocodiles (Caiman crocodilus), caymans, turtles and fish in these water bodies.

1.3.4 Socio-Economic Characteristics

The principal economic activity of Tibú is commerce, followed by oil exploration, agriculture and livestock and forestry activities (wood extracted from natural forests). Notable crops are Cacao, plantain, maize, yucca, coffee, sugar cane for *panela* [Colombian

hardened molasses], and technical rice cultivation; and on a lesser scale, beans, avocado and fruit crops (citrics and *zapote* [*Matisia cordata HB]*).

The southern region of the Bolivar Department is characterized by subsistence agriculture with small-scale landholders located in higher-altitude areas to the west of the Serranía de San Lucas and its foothills. Farmers grow maize, yucca, plantain, and Cacao. Only a minimal surplus production is sent to market. The most important crop is beans.

Cattle-raising has always been an important activity in the region but is currently in crisis due to extorsion activities undertaken by outlaw organizations.

1.3.5 Social Conflict

The conditions of structural poverty, reflected in the highest indexes of basic unmet needs as well as illiteracy, together with the political violence of the surrounding region, explain why poor farmers resort to coca cultivation, wood exploitation and mining –while nevertheless being unable to rise above the subsistence-living barrier.

The most critical factor in municipal areas is public law and order due to the presence of both legal and illegal armed groups in the same territory, as well as cocaine-base producers and buyers. This has necessarily led to confrontations, human rights violations affecting the civilian population, and deterioration of the productive activities of the region.

The presence of illicit coca crops has thoroughly affected the local way of life, traditional farming and animal husbandry production, and the social fabric of the regional population. There is widespread violence, illegal groups have even taken over basic food produce and there are few jobs available due to competing activities such as growing, harvesting, collecting, and processing coca leaves –activities that generate much higher income. The family unit has also broken down and there is child prostitution and a high level of desertion from the educational system.

1.4 IDENTIFICATION OF ENVIRONMENTAL IMPACTS

1.4.1 Methodology

This part of the Environmental Assessment correlates the current environmental conditions of southern Bolivar and Santander del Norte (Tibú) with the different implementation and operation activities undertaken in the Cacao cultivation project. This is done to identify possible effects, determine which of those effects may have an impact, and ultimately to qualify and classify the impacts, in order to design control and management programs according to the environmental quality standards expected from a USAID financed project.

The evaluation process identified 1,484 possible impacts, which were assessed by the team of consulting specialists according to the information gathered during the visits made to project beneficiaries, municipality officials and to documentation supplied by the project operator FUNDESCAT, USAID, Chemonics de Colombia, the Plan Nacional de Desarrollo Alternativo [National Alternative Development Plan] and the Environment Ministry, using the environmental guides from both the Norte de Santander and the Bolivar Autonomous Corporations (CORPONOR and CSB), whom by law are environmental regulators.

From the identified potential impacts, 634 had interactions with 403 positive environmental effects while 231 showed negative environmental effects.

1.4.2 Results

An assessment of the environmental components reveals more pronounced negative effects in regard to water and the biotic components and less for Edaphology [soil science]. Positive effects are those regarding the socio-economic and socio-cultural components.

A comparison of positive and negative impacts reveals that water is associated with a greater number of negative impacts, followed, a considerable distance apart, by the Biotic and Geomorphology components. The Socio-cultural and Socio-economic components continue to have a positive impact. The least positive effects are associated with the Edaphology and Climate components.

This same assessment performed on project activities shows that the sub-activity with the greatest positive effects are Food Security, followed by Commercial Logistics.

As for the negative effects --the activity producing the highest impact is agroforestry, followed by crop installation and maintenance and then the processing activities. Most negative interactions are due to the application and inadequate use of the agro-chemical products required for Cacao cultivation.

Another set of concerns are the socio-cultural vicissitudes that might affect the population in its adaptation to new cultivation techniques and to long term production and marketing required for Cacao.

1.5 ENVIRONMENTAL EVALUATION / RATING

1.5.1 Methodology

An environmental evaluation is performed for the two Cacao Project alternatives, taking into account the similarities between the majority of the ecological and environmental conditions of the southern Bolivar and Santander del Norte (Tibú) regions, under the following criteria: Geographical Location, Orography [relief features], Climate,

Hydrography, Services Infrastructure, Productivity, Land Use and Socio-Cultural and Economic Fitness.

The values expressing the qualitative and quantitative magnitudes were determined by means of environmental quality parameters that were related to each other using an environmental rating indicator [Environmental Rating (ER) – *Calificación ambiental (Ca)*].

1.5.2 Results

From the list of identified impacts, an average of the different values for Ca reported that the component producing the greatest environmental modification is water, influenced mainly by crop installation and crop maintenance work. This environmental modification is Very Low (VL) [*Muy Baja (MB)*] for this component as well as for geomorphologic aspects --also Very Low (VL) or *Muy Baja (MB)*. This means that arithmetic averages range between 0.0 and 2.0 where the maximum value is 10.0. The impact produced by project activities, whether in Cacao single crop cultivation or agroforestry arrangements, is not significant enough to produce a representative change in the present situation, as the areas to be intervened by project activities are located in agricultural units that are distant from each other. The area of these units does not exceed 3 hectares (7.41 acres).

Some indirect potential impacts were identified, if the current use of agrochemicals for illegal crops were to be continued, however, the project itself is keen on using pesticides the least possible and tending instead towards ecological or even organic produce. Cacao requires very little chemicals and being associated with other crops diminishes the exposure to pests, allowing for future potentially organic produce, though currently the regional and national markets for this are not ripe. The use of water is limited and controlled, as per the EMP that follows in the next chapter, and no other potential impact could migrate beyond the borders of the project's direct area of influence.

For the pesticide analysis, reportedly the highest potential impact, a full scale Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) has been presented within this document, following all 12 issues presented in Regulation 216. Following the analysis, the toxicity and a list of exclusions, a Integrated Pest Management (IPM) option is presented for each pest and chemical evaluated.

The remaining environmental components, Socio-cultural, Socio-economic, Biotic, Climatic, and Edaphology have a positive environmental rating.

1.6 ENVIRONMENTAL MANAGEMENT PLAN - EMP

1.6.1 Environmental Guidelines

The Environmental Management Plan includes the specific detailed factors that may produce environmental effects, the mitigation measures foreseen and the strategies used to

monitor the activities. Each factor includes the Type of Measure, Activities that Produce Impact, Environmental Effects, Designs, Description of the Measure(s), Timetable, Monitoring and Follow-Up with the estimated total Costs.

The Environmental Guidelines established for the environmental control of the Cacao Project in the southern Bolívar and Santander del Norte (Tibú) sub-regions, include the following plans:

- Biotic Resource, the Plant and Animal Management Plans;
- Water Resource, the Liquid Residues Management Plan and Water Use and Water Quality Management Plan;
- Edaphology Resource: Soil Resource Management Plan, Solid Residues Management Plan and Agrochemical Products Management Plan;
- Socio-Economic Resource: the Food Security Plan, Support and Accompaniment Plan, Business Training Plan, Environmental Education Plan and Industrial Security Plan.

Each one of these Guidelines includes a description of the activity, the person responsible, an estimated cost and a brief description of any building designs if these are required. In order to allow for correct implementation of the EMP and hence avoid any environmental impacts, an additional managerial tool for follow-up is presented in the next chapter.

1.6.2 Monitoring and Follow-Up Plan

The Monitoring and Follow-Up Plan (MFP) *[Plan de Seguimiento y Monitoreo, PSM]* is the tool containing the detailed programs obtained after the impacts were identified. These detailed programs make it possible to verify, monitor and assess project actions and activities before, during and after project execution.

The Plan provides detailed indicators and locations where monitoring is to take place as well as the specific methodologies recommended for sampling and verification, including frequency, duration, type of assessment and evaluation method. This is the case for the physical-chemical monitoring of bodies of water and soil intervened by the project, advances made in the fauna and flora management program, advances made in the solid residue management program and advances made in the community service program.

The Plan establishes detailed criteria and indicators that facilitate decision-making on unexpected situations, which also helps minimize the adverse environmental effects.

1.6.3 Environmental Management Unit

The creation of an Environmental Management Unit has been considered appropriate for the implementation of the Environmental Management System, that should include the Management and Monitoring Plans. The Environmental Management Unit will be

responsible for ensuring that the environmental management measures are executed in accordance with the recommendations contained in this environmental assessment.

The environmental policy has been designed based on the results obtained in the environmental assessment, which provides the necessary input information for planning. An organizational structure will be set up to define the administration, coordination and execution of the environmental management system, the financial and physical resources, procedures defined, communications flows and operational controls.

The follow-up phase includes verification of the effectiveness and efficiency of the environmental measures implemented. It is based on activities such as monitoring and measuring the characteristics of key operations and activities that produce environmental effects, defining responsibilities and managerial authority, investigating and correcting inconsistencies, maintaining environmental records, and periodically performing environmental audits to determine if the environmental management system has been properly implemented and maintained according to plans.

1.6.4 EMP Costs

The estimated costs of the Environmental Management Plan, including the four components presented above, is approximately Col $ 258,722,600 (US$89,835.oo).

1.7 CONCLUSIONS AND RECOMMENDATIONS

The Cacao project's considered alternatives present physical and agrological characteristics that signal favorable results due to the agro-forestry plan and the constant improving of the standard of living of the *campesinos* [or local farmers] of the area of influence. This is accomplished by increasing production and employment opportunities for local labor. However, this is not the case for the social and public law and order aspects, which somehow limited the environmental assessment, and in the future may impede support for and execution of the project.

The Cacao planting, cultivation and processing necessarily generate environmental effects, including highly beneficial changes that improve agricultural production in the regions of southern Bolívar and Norte de Santander (Tibú).

According to the Environmental Rating (ER) *[Calificación Ambiental (Ca)]* obtained, the alterations produced by the Cacao project on the natural environment (including humans) are of Very Low (VL) *[Muy Baja (MB)]* Environmental Significance (ES) *[Importancia Ambiental (IA)]*. These modifications may be controlled by means of the Environmental Management activities proposed for the project.

SECTION 2 PURPOSE

The main objective of this Assessment is to analyze the physical, biotic and socioeconomic aspects in the project zone of influence in regards to cacao crop farming, including identification and assessment of impacts caused by project implementation and operation, to establish environmental management and monitoring measures that provide for sustainable development of the project during all phases of development and beyond completion of the project. The activities formulated will provide comprehensive information on effects on the environment related to implementation and management of productive agricultural arrangements, that will assist managers and administrators in decision making processes.

2.1 SPECIFIC OBJECTIVES

- Preparation of the Environmental Diagnosis, including aspects of interest relative to implementation of the project in the designated municipalities throughout the life of the project.

- Preparation of the Environmental Assessment using the Leopold Matrix to identify impacts, quantification of the degree of affectation and proposal of environmental management measures.

- Formulation and design of preventive, mitigation, corrective and compensating measures required by the physical, biotic and social project components in harmony with the affected environment. These measures will include objectives and goals, expected results, design criteria, construction plans for specific project components, human resources, programming schedules, costing and responsible parties.

- Preparation of a biophysical and social monitoring follow-up program, to meet environmental alterations caused by project activities and processes during the life of the project.

2.2 METHODOLOGY

In preparing the EA, methodologies accepted by official environmental organizations were used. The se methodologies include: identification of project direct and indirect areas of influence; characterization of the environmental base line including physical, biotic, social and economic aspects; and identification *in situ* of impacts generated by the project. Field work included interviews with the community and participating agencies. The interviews indicated general project acceptance by all involved parties.

Primary and secondary information on project area was collected in the field, the analysis and assessment of this information was done in the office and utilized in the environmental assessment.

Matrices were utilized in identification and quantification of environmental affectations, supported by listings, graphs and field observations, with participation of the community and institutions. This allowed for determining interaction between environmental variables in the study areas and areas under the influence of the project.

Analytic information and elements of judgment used by consultants that participated in analyses of thematic phases of the agricultural plan are included in the project environmental assessment, or inserted in other parts of the overall study for assessment or general purposes.

The Environmental Assessment is supported by multi-thematic research, evaluated and analyzed by environmental specialists to determine the benefits and limitations of illicit crop substitution by planting and producing cacao. This information was used to formulate and design measures in the Environmental Management Plan, as well as the methodology used for control, monitoring and follow-up to be carried out by the environmental authorities and supervisors, upon implementation of the PMA.

The Environmental Assessment structure include the following themes:

- Project environmental description Environmental Base Line
- Environmental Diagnosis conclusions
- Description of the agricultural project
- Project environmental identification and assessment
- Project Environmental Management Plan
- Monitoring and Follow-up Plan

SECTION 3 ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.1 ASSESSMENT METHODOLOGY

Two matrices were assessed to quantify beneficial and adverse effects that may be caused by implementation or no-implementation of the PMA, in order to determine the incidence of PMA activities.

There are two access elements in the matrix. Environmental resources affected by project activities and related environmental management measures appear in the upper part of the matrix. Affected environmental elements are part of biotic, water, edaphic, climate, socio economic and socio cultural resources.

Productive project activities affecting environmental resources are shown on the left side of the matrix, the list of activities include: plant nurseries, crop installation and cacao processing installations, food security, marketing logistics and maintenance, agro-forestry, old cacao plantation renewal, project support.

Qualification parameters were selected according to the following criteria:

1) Importance: Relevancy of environmental management measures selected for decreasing of compensating impacts on environmental resources, generated by the productive project. The range of importance is classified as high (0.7), medium (0.5) and low (0.2).

2) Location: the space in which the environmental management measure takes place. Space may be local (0.3), when the effect takes place in the project area of influence; or extensive (0.7) when the effect is localized in the regional or indirect project area of influence.

3) Evolution: the elapsed time from application of the measure to reaction of the affected environmental resource. This could be rapid (0.6), when the effect occurs within the first year; medium (0.4), when the effect takes place from 1 to 2 years, and slow (0.2), when the effect takes place after two years.

Upon determining the scale of qualification, the condition of project matrix analysis is done for the two variables: with implementation or without implementation of the PMA. The sum of positive and negative values of each effect indicated in the matrix rows is calculated separately. Values obtained are added arithmetically to determine the global effect produced by the activity (with or without the PMA) on environmental resources.

The values for each environmental resource appearing in the matrix columns are added arithmetically. The value obtained represents the response of the resource to implementation of the relevant project activity with or without implementation of the PMA.

Finally, the values obtained from the additions in the matrix rows are shown as a graph, as well as the values assigned in grading the columns.

Figure 1 shown the matrix assessment and evaluation for project activities' implemented in parallel with the environmental management measures.Figure 2 shows the assessment if the Project continues without application of the PMA.

3.2 RESULTS ANALYSIS

3.2.1 The No Project Alternative

Environmental and socioeconomic conditions in the project zone, especially in regards to proliferation of illicit crops due to lack of economic opportunities, suggests that rural population will continue to depend on illicit crops as the most important source of income, perhaps the only source… Affectation of the environment in the zone caused by illicit crop activities , along with social conflict and poverty levels, will continue to the increase, as the agricultural frontier will extend towards protected zones. Contamination of watersheds will surely increase due to indiscriminate use of agrochemicals and deforestation leading to widespread erosion.

The magnitude of impacts under these conditions can not be determined in the same manner that in other scenarios, as it can not be compared to productive project activities. Therefore, the conclusion is that affectation of the environment will be worse, the socioeconomic component (the main objective of productive, sustainable projects such as cacao) will be hard hit, if the cacao project and extensive agricultural projects are not implemented in the zone.

3.2.2 Project with PMA Implementation

Project activities within environmental management development, can be ordained horizontally using the matrix in Figure 1 to consider incorporation of environmental components.

Activities such as installation and crop management (-3.79), seedling nurseries (-3.57) and cacao processing areas (-3.57) generate negative impacts even if environmental management measures are applied. Other cacao project activities produce positive impacts, especially agro-forestry (+9.0) and renewal of old cacao plantations (+7.10).

Following the discussion above and after calculating the balance between positive and negative effects, it may be concluded that implementation of the environmental management plan, including the adverse incidence of activities such as installation and crop

management and the nurseries, the final result of affectations is low(-1.50; -1.43). In the case of the cacao processing site, the positive effects are larger, and the overall balance of effects generated by the project turns out positive (+1.57).

Activity	Positive Effect	Negative Effect	Balance of Effects
Nursery	2.14	-3.57	-1.43
Installation and crop management	2.29	-3.79	-1.50
Agro-forestry	9.00	0.00	9.00
Renewal of old plantations	7.14	0.00	7.14
Cacao processing sites	2.57	-1.00	1.57
Food security	2.57	0.00	2.57
Marketing logistics	2.57	0.00	2.57
Project support (*Accompaniment*)	2.57	0.00	2.57

Response of environmental resources to implementation of activities developed with PMA management measures can be established evaluating the vertical matrix grading.

As can be seen in the matrix and table above, most environmental resources are positive, except the water resource. Water will not recuperate completely considering actual project caused affectations.

As far as the socioeconomic resource is concerned, the effects are positive given the fact that the objective of the cacao productive project is to extend benefits to marginal groups not cared for presently by the State, and that have turned to illicit crops to make a living. This resource receives greater benefits from implementation of the PMA, as the productive project sustainability is assured with actions leading towards preservation and adequate management of environmental resources.

Resource	Effect Grading
Biotic	0.33
Hydric	-0.33
Edafologic	3.67
Geomorphologic	4.00
Climatic	3.33
Socioeconomic	5.07
Sociocultural	4.33

3.2.3 Project Without PMA Implementation

If the project is implemented without the PMA, the vertical analysis of the matrix indicates that most resources will continue to deteriorate in the future and/or resource quality will worsen; thus, the overall matrix grade will be negative, except for the socioeconomic resource.

If the project continues without environmental management measures, the hydric resource will continue to be negatively affected (-9.67), followed by the geomorphologic resource (-5.0) and the biotic (-4.33). The edafologic and climatic resources (-3.67 and -3.33) will also be affected negatively. These resources are affected by installation and maintenance of the nursery and crop.

Positive effects of the project on the socioeconomic resource without PMA, will decrease considerably, as the cacao productive project will continue to affect natural resources negatively until they are depleted. This would result in abandonment of this type of projects, followed by negative implications over the socio economy of the region.

Resource	Effect Qualification
Biotic	-4.33
Hydric	-9.67
Edafologic	-3.67
Geomorphologic	-5.00
Climatic	-3.33
Socioeconomic	2.83
Sociocultural	2.70

The horizontal analysis of the matrix indicates that major negative affectation of activities will increase without PMA, especially installation and crop cultivation, registering -6.4 and the nursery registering -5.71. The cacao processing sites registered -1.0. The remaining activities registered positive ratings, i.e., they are beneficial to the environment..

The balance of negative and positive impacts, indicates that negative affectations generated by installation and maintenance of crops and nurseries continue to affect the environment, while the cacao processing sites activity decreases somewhat, positive impacts are greater than negative impacts. The remaining activities register positive readings resulting in overall positive rating. Agro-forestry (+6.57) and renewal of old plantations (+4.14) continue to generate positive impacts on the environment. See table below.

Activity	Positive Effect	Negative Effect	Balance of Effects
Nursery	1.57	-5.71	-4.14
Installation and crop management	1.14	-6.14	-5.00
Agro-forestry	6.57	0.00	6.57
Renewal of old plantations	4.14	0.00	4.14
Cacao processing sites	1.42	-1.00	0.42
Food security	1.42	0.00	1.42
Marketing logistics	1.42	0.00	1.42
Project support (*Accompaniment*)	1.42	0.00	1.42

Finally, the comparison of CA values obtained for environmental resources in stages prior to this Environmental Assessment is analyzed, in regards to CA values registered if the project is implemented with the PMA and values registered in the assessment of the project

without PMA. The purpose of this comparison is establishing the positive or negative affectations on the environment if the productive project is implemented with or without PMA measures.

The comparative analysis of environmental resources in regards to conditions studied follows below.

Water (hydric) resource registers the highest CA (-1.16) negative impact increasing -9.67, and decreasing with application of the PMA (-0.33).

The geomorphologic resource registers negative effects of -0.67, but without PMA the affectation registers -5.0, and with the PMA, the CA value is +4.0.

The edafologic resource presents an actual CA positive value of low magnitude, but if the PMA is not applied, the CA value increases to-33.67. If the PMA is applied, the resource indicates the same positive value as the CA.

The climatic resource presents a CA positive reading (+0.33). If the project is implemented with environmental management measures, theca value increases to +3.33. On the contrary, if the PMA measures are not implemented, the CA value decreases to -3-33.

The socio-cultural resource registers the highest CA rating at +3.37. Implementation of the PMA the CA improves to +4.33; and without the PMA, the CA decreases to +2.70. The same situation is reflected on the socioeconomic resource, presently registering a CA value of 2.70. If the PMA measures are not applied, the CA remains the same; but if the PMA measures are applied, then the CA increases to 5.07.

Resource	Actual Project Condition	Project and PMA	Project Without PMA
Biotic	0.66	0.33	-4.33
Hydric	-1.16	-0.33	-9.67
Edafologic	0.22	3.67	-3.67
Geomorphologic	-0.67	4.00	-5.00
Climatic	0.39	3.33	-3.33
Socioeconomic	2.83	5.07	2.83
Sociocultural	3.17	4.33	2.70

3.3 CONCLUSIONS

The productive Project results in better and more beneficial impacts in general if implemented together with an Environmental Management Plan (PMA). This does not mean that the productive project, by itself, will generate economic reactivation in the project zone in regards as a substitute to illicit crops, but rather, that soil exploitation under the project, will continue to be sustainable in the future.

The No Project Alternative will result in worsening the environmental resources situation, specially the socio economic conditions in the region.

SECTION 4 THE AFFECTED ENVIRONMENT

4.1 PROJECT DESCRIPTION

4.1.1 Location and Project Scope

The project is located in the municipality of Tibú in the department of Norte de Santander and in the South of the department of Bolivar, in the municipalities of Río Viejo, Simití, Santa Rosa del Sur, San Pablo, Arenal, Morales and Cantagallo.

The project goal is to establish 1,500 ha of cacao in Tibú and 1,600 ha in seven municipalities in the South of Bolivar. The latter phase will be developed in two stages: the actual stage comprising 22 cacao parcels of 1 ha each, and the future stage comprising 1,600. Matching funds are not available as of to date for this stage.

The project aims towards consolidation of the agroforestal sector and plantain (associated crop), and a food security model project featuring corn and beans, within a sustainable alternative proposal that will result in income generation and environmental improvement to curve expansion of coca crops, and improve living standards and recuperation of self-esteem of farmers in project locations.

Direct project benefits include:

- Assist 500 small cacao farmer families in establishing and consolidating Family Productive Units, in 3-hectare parcels of cacao; and indirectly, 2,000 cacao families in the region (10,000 individuals, approximately)

- Generate 496,960 daily wages during three years, distributed as follows: 245,960 in the first year, 143,500 in the second year, and 107,500 in the third year.

4.1.2 Crop Project Activities

The specific crop activities of the project, subject to project environmental assessment in the future, include:

- Production of seedling material (nursery)

Cacao clone seedlings are being produced of TSH 565, ICS 1,6,60, CCN 51, CAP 34, IMC 67 y UHF 613 varieties and *Harton and Dominico* plantain, using clones and merystems for reproduction.

The nursery is located in the municipality of Tibú is part of the project operated by the Fundación Catatumbo with support of GGT, Honduras. Cacao seedlings are produced to supply material to the productive project. Pictures 17-20 in the Photographic annex to this Study, show plantain and cacao production and management processes in progress.

Strict programming of cultural activities are carried out at the nursery including disease and weed control techniques. Seedling production is certified by ICA. Nursery installation meet specifications for this type of installations.

A form of *campesino* economy has been developed in the Sur de Bolivar subproject staring from colonization processes, featuring low-yield production systems due to low-technological levels, minimal investment and poor support infrastructure (credit, technical assistance, infrastructure and farm machinery).

Most productive systems use local technologies based on local seeds. Poor support infrastructure , marginal farming areas and low product prices have held back sector economy. Similar management has been proposed for the Tibú subproject. State, trade and private sector (Luker and Nacional de Chocolates) coincide in recommending a technological package to establish modern farming, based on high-yield cacao clone Plant Propagation (grafts), pest and disease resistant, precocious growth and high-quality fruit.

Already grafted material will be used in establishing 1,599 ha cacao plantations (533 Productive Family Units are proposed), each PFU will have 3 hectares. Recommended cacao material for this subproject are cacao clones TSH 565, ICS 1,6,60, CCN 51, CAP 34, IMC 67, UHF 61and SCC 61.

Using the Tibú subproject system, plantain shade material will include the *Hartón and Dominico Hartón* varieties, as well as the same forestry species used in Tibú.

The National Federation of Coffee Growers established a nursery in Cantagallo for production of cacao seedlings. Photograph No. 28 in the Photographic Annex indicates the type of material that is produced at this nursery.

- Installation and Crop Management

Activities corresponding to installation and crop management include preparation of soil, transplants, planting transplants, aerial pruning, and application of fertilizers, irrigation, pest, disease and weed control. The following is a detailed analysis the latter.

- Pest, disease and weed control

Control of phytosanitary problems, including pest and disease, is one of several aspects of cacao farming integral management; climate, soils, seedlings, genetics and management are the pillars upon which crop productivity and economic yields rest.

Integral Management of Pests and Disease (MIPE) activity objective is lessen conditions favorable to plant disease, such as fungi and pests, rodents and insects. Achievement of this objective stars with crop planning and installation.

Cacao plantations are prone to endemic disease and pest attacks, all over the cacao producing zones countrywide, these include:

- Moniliasis (*Moniliophthora roreri*)
- Witches broom (*Crinipellis perniciosa*)
- Brown cob rot and trunk cancer (*Phytophthora spp*)
- Machete disease (*Ceratocystis fimbriata*)
- Star wound (*Rosellinia pepo*)
- Yellow mite (*Monalonium dissimulatum*)
- Red mite (*Monalonium annulipes*)

In extreme situations, agrochemicals may be used after exhausting biological and cultural procedures. Tordón is an herbicide recommended for weed control. Fungicides such a Copper Oxichloride are used to control cacao diseases. Entomophatogens work well in pest control. Pesticides are used in nursery areas, following industrial safety practices (se Photograph No. 27)

The following is a list of agrochemicals that have been used in the first project stage, and in others to follow later. These pesticides are not banned. Operators are cautioned to receive instructions on the use of pesticides before applications, according to Environmental Guidelines No. 12 and No. 13 in the Environmental Management Plan.

PRODUCT	USAID RESTRICTION	
	YES	NO
Gliofofed		X
Furadan		X
Clorpiricol		X
Bezil		X
DAP		X
KCl		X
Copper oxichloride		X
Ridomil		X
Roxion		X
Malathion		X

- Fertilizing

Red worm humus is recommended in crop fertilizing activities, along with minor elements to be applied directly on soils, such as potassium, magnesium and phosphorus.

- Agro-forestry

The recommended associative systems in cacao crop farming is to include plantain, wood trees associated with corn – beans. Recommended plantain material are the *Hartoón and Dominico Hartón* varieties, duly certified, to guarantee genetic quality. (see photographs 14, 15, and 16)

Fruit trees are not recommended for shading, as they are prone to pests and disease (Rincón, 1982), other trees may be used for cacao shading, as follows:

Table 1. Species Recommended for Cacao Shading

SPECIE – LOCAL NAME	SCIENTIFIC NAME
Anaco rojo	*Eritrina poeppigiana*
Balso	*Ochroma pyramidale*
Búcaro	*Eritrina fusca*
Caracolí	*Anacardium excelsum*
Cedro	*Cederla odorata*
Chachafruto	*Eritrina edulis*
Orejo	*Enterolobium cyclocarpum*
Guácimo	*Guazuma ulmifolia*
Gualanday	*Jacaranda caucana*
Guamo machete	*Inga densiflora*
Guayacán Amarillo	*Tabebuia chrisantha*
Guayacán Rosado	*Tabebuia rosea*
Jalapo	*Albizzia carbonaria*
Leucaena	*Leucaena Leucocephala*
Mata ratón	*Gliricidia sepium*
Móncoro (Nogal Cafetero)	*Cordia alliodora*
Nauno	*Pseudosamanea guachapele*
Samán	*Pithecellobium saman*
Teca	*Tectona grandis*
Terminalia	*Terminalia ivorensis*

- Renewal of old plantation

This activity is applied in the Sur de Bolívar subproject. The cacao project sis the alternative to renew 1,600 ha of old cacao, and promoting agro-forestry plantain associated crops and forestry species (cedar and *móncoro*), to recuperate the cacao tradition in the region, stop expansion of coca crops, improve the level and quality of life of rural residents and recuperate deforestation and erosion soils.

- Cacao processing

This activity include the process of cacao from harvesting right on to marketing.

- Collection

Cacao cobs are harvested upon ripening (Photograph 29). Ripening takes place in 160 to 185days. Tools used include cutters, half-moons and *desjarretadoras*-

- Cutting and peeling grains

Cacao cobs are cut using a machete, splitting them with a wood hammer or tearing them apart in a special machine to extract grains. Disease cacao grains must be separated from healthy grains.. These activities are carried out within the plantation grounds.

- Fermentation

Fermentation consist in piling up fresh cacao grains in wood bins, burlap bags or in vegetal fifer baskets. This is done to start fermentation, an external and internal almond biochemical process that removes mucilage, kills the embryo, conserves cotyledons and generates the characteristic aroma and chocolate flavor. Fermentation usually is done within 5 to 6 days. The grain mass must be turned over every two days to increase acieration and facilitate chemical reactions that produce the color and flavor. There are other type of fermenting bins, such as square wood boxes, double boxes, wood barrels, canoes, etc., that vary in size and are used as needed in cacao farms. (see photographs 30 and 31)

- Drying

Drying of fermented grain is used to take off any remaining humidity. Marketing-class cacao must have humidity of 7 to 8% maximum. Many drying methods are used, the most common are:

- Sun drying

This is the most popular method used universally to dry cacao grains. Sun drying is done by placing the grain in wood stretchers, pliable carts and fixed wooden platforms (Photographs 32 and 339, *caña brava* (wild cane) and bamboo mats are also used. The maximum thickness of the layers of grain should not exceed 5.5 cm. Drying time varies: in clear weather, high sunshine, the grain may dry in 18 to 24 hours, drying takes longer in cloudy days. Grains must be turned over while drying using wood racks.

- Artificial drying

This system is used in humid zones, in which harvesting periods coincide with rainy weather. Several artificial driers are in the market, such as 7-stoves, *guardiolas* and Samoan driers.

- Cleaning and grain selection

Market-grade cacao must be free of dirt, impurity and foreign matter, such as shrunk and damaged grains, damaged grain due to placenta conditions, stones, trash, etc. This activity is hand-made or using sieves and fans.

Upon completion of the activities above, cacao grains are packed in sacks and the product is ready for marketing.

- Generation of solid waste

Solid waste in cacao process is generated in cob breaking and removal of diseased or insect damaged grains. These grains must be handled with care to avoid disseminations of pests and disease.

Cacao project activities and management of agronomic practices, are supported y technicians in field and study trips. (see photographs 34. 35 and 36)

- Food security

One of the problems faced by the project is that farmers are reluctant to accept long unproductive periods and suggested spacing between rows. It is necessary then, to implement associated crops to allow for extra income, to sustain the plantation and the farmer's family until harvesting time, as well as cash and small-species that will help in diversification of traditional diet during the installation and cultivation stages.

- Marketing logistics

This Project stage consists in commercial arrangements with trade associations to assure product marketing, and important linkage to production processes. This activity allows for support by the participating partners in marketing, product storage, transport and product quality control. The cacao growers associations play an important role in marketing logistics.

- Project support (*Accompaniment*)

Cacao farmers will have crop support provided by professionals and technicians, in farming related aspects such as:

Integral training for technicians and specially, for small farmers, to unify criteria in application of the technological package and the cooperative-organizational part, including marketing-commercialization support.

Strengthening the cacao sector in each municipality, assuring participation of the association of cacao growers and community cooperatives, existing and future, to manage financial resources in support of project beneficiaries, headed by the Cacao Municipal

Growers Association, in all phases of cacao crop farming, and managing the productive chain to purchase inputs, goods and services.

Voluntary eradication of 700 ha of coca in the project area.

Assist 500 small cacao farmer's families directly, towards establishing and strengthening Family Productive Units, in 3-hectare plots, and indirectly, to 2,000 cacao families in the region (10,000 persons, approximately)

Generate 496,960 person/wages in three years, distributed as follows: 245,960 during the first year, 143,500 in the second year and 107,500 in the third year.

Strengthening of producers is also part of the project, assuring their participation to obtain interaction levels that permit their integration as useful members of the community.

4.1.3 Status of the Norte de Santander (Municipality of Tibú) Subproject, to Date

CAD Grant Agreement No. 004-03-01, "Renewal of 1,500 hectares of Cacao in the Catatumbo Region in the municipality of Tibú, Colombia" financed by Chemonics/USAID, seeks to eradicate 700 ha of illicit crops, through voluntary eradication pacts, and planting 1,500 ha of cacao (renewal of old plantations) to benefit 500 participating families (3 ha of cacao per family).

Implementation of the project will be under the Fundación para el Desarrollo del Catatumbo – FUNDESCAT. Project grantee is the Asociación Gremial de Productores Cacaoteros de Tibú – ASOCATI. Other Project participants are the Plan Nacional de Desarrollo Alternativo – PNDA and the Alcaldía del Municipio de Tibú.

The Grant Agreement was signed on October 21, 2001. Project duration is 36 months, project cost is COL$18,300,048,000, Chemonics grant value is 66.12% of the project cost.

According to the project monthly progress report No. 13 of 2003, submitted by FUNDESCAT, selected project indicators to January 31, 2003, indicate that:

Table 2. Subproject Indicators. Cacao Norte de Santander (Tibú)

COMPONENT	PROGRAMMED	CUMULATIVE JANUARY 311/03	% COMPLETED
Families benefited	500	303	61
Hectares eradicated	700	313	45
Hectares planted	1,500	586	39

4.1.4 Status of the Sur de Bolivar Subproject to Date

Cacao plating is behind schedule, in spite of edafo-climatic favorable conditions. The reason for the delays is that the project was introduced at the same time that migrant farmers from Santander del Norte and Santander del Sur, the principal cacao producers in

Colombia arrived in Sur de Bolivar, with old cacao farming methods and little knowledge of cacao management. This explains predominant old plantations (20-30 years-old), in a state of abandonment, low-production, low-yield (250-300 kg/ha average production), improper pruning, phytosanitary control, shade management and other key farming activities that contribute to low incomes.

The objective of CAD Grant Agreement No. 006-03-1, financed by Chemonics/USAID is the transference of technology for improving cacao production in 22 production nuclei in Sur de Bolivar.

The Federación de Cacaoteros – FEDECACAO acts as the Project implementing agency. The Plan Nacional de Desarrollo Alternativo PNDA, Alcaldías Municipales, UMATAS and the Juntas de Acción Comunal participate in the Project.

The Federación de Cacaoteros – FEDECACAO was in charge of Project implementation at the local level.

The project Grant Agreement was signed on November 27, 2001. The project lasted 12 months, project cost was COL$153,732,000, Chemonics financed 75% of project costs.

According to the final project report dated November 15, 2003 submitted by FUNDECACAO, selected project indicators, indicate that:

Table 3. Sub Project Indicators. Cacao Sur de Bolívar

COMPONENT	PROGRAMMED	CUMULATIVE TO JANUARY 31/03	% COMPLETION
Families benefited, UPC	22	22	100
Hectares of demonstration crops	22	22	100
Producers trained	440	386	88
Professionals and technicians trained	20	20	100
Grafters trained	22	50	227

4.2 DESCRIPTION OF THE PROJECT AREA

4.2.1 General Description

The purpose of this section of the Environmental Assessment in to gather, analyze and assess available secondary information on natural resources in the project area of influence, to complete an environmental characterization of the region and its inter-relationship with technical specifications of licit agricultural crops.

4.2.2 Area of Influence of the Project

- **Local area of influence**

These areas include two distinct zones: Sur del departamento of Bolívar, including the municipalities of Arenal, Cantagallo, Morales, Río Viejo, San Pablo, Santa Rosa Sur and Simit, near the Magdalena River; and the municipality of Tibú, in the department of Norte de Santander, including tour areas: the Tibú zone, the Campo Dos zone, the Pacelli zone and the La Gabarra zone. (See Figure below).

This territory is a marginal region with high poverty indexes, in the mist of political strife, social and economic issues, and frontier spontaneous settlement migrations dedicated to illicit crop farming.

- Regional project area of influence

The Environmental Assessment study refers to the status of hydrographical watersheds such as the Bosque river and the La Inanea and San Blas creeks in Sur de Bolivar, and the Catatumbo and Tibú basin water sheds that are highly intervened by agrochemical contamination from illicit and licit crops.

Confrontation these areas with geographical spaces containing forest reserves or special environmental protected zones established by the ministry of the Environment, indicates that the project zones located in the Sur de Bolivar and the municipality of Tibú corresponded actually to the Magdalena River Forestry Reserve as per Law 2 of 1959; however, in Sur de Bolivar, according to Acuerdo 02 of 1976 enacted by INDERENA and Resolutions 219 of 1974 and 178 of 1974, enacted by INCORA, for sectors in Tibú, the two project sub regions have been removed from the Forestry Reserve, and assigned to multiple use.

A separate description of the environmental condition of said sub regions is available for better understanding of prevailing conditions.

4.2.3 Cacao Project in Norte de Santander (Municipio de Tibú)

Physical characteristics [1]

- Location

The geographical coordinates of the capital of the municipality of Tibú are 8º 38´53´´ North and 72º44´22´´ West. Altitude over sea level ranges from 47 to 1,400 m. Tibú is 109 km away from Cúcuta, the capital city of the department of Norte de Santander. See maps

[1] Documento de formulación Proyecto Cacao Norte de Santander
Plan de Ordenamiento Territorial.

of the department of Norte de Santander and physical-hydrographical of the study zone attached.

- Climate

The agro ecological zones of the municipality of Tibú correspond to the humid tropical forest (bh-T and very humid tropical forest (bmh-T), rainfall registers 2,500 mm p.a., average temperature is 30^{o}C and relative humidity is 75 to 85%.

Rainfall variations cause flooding of rivers and creeks. See photographs 9, 10 and 11. Eutrofication has been registered in some cases due to fertilizers and organic matter runoffs. See photographs 12 and 13.

75% of rainfall in the department of Norte de Santander is influenced by the Lake of Maracaibo zone; wind action is distributed along the greater Catatumbo river basin.

- Geology and Geomorphology

The surface of the municipality of Tibú presents basement rocks of the pre-cretacean era, composed of igneous and metamorphic rocks. Marine cetacean era sedimentation is also found, in the Uribante, Cogollo, La Luna, Colón, Mito Juan, Catatumbo terciary formations, corresponding to the Barco, Los Cuervos, Mirador, Carbonera, León, Guayabona, Necesidad formations, of marine and continental origin.

The area of the municipality presents different topographical conditions, from plains and slightly undulated zones to high and broken zones in the Motilones Sierra. Some sectors present morphodinamic processes type mass removal, including landslides and erosion.

- Soils

Soils in Tibú include agro ecological categories class II and III and class VII and VIII. Cacao zones are localized along river banks abundant in the region, these are alluvial soils of frank, frank-sandy and clay-sandy texture, permeable, medium acid (pH 5.8 and 6.5), medium fertility and plain to slightly undulated topography.

In summary, the forests in the region may be defined as landscape units or physiographic, within hydrographical ecosystems, represented by flat and undulated cabañas, hills covered with natural vegetation. The existing forests correspond to deep dissected and plain terrace forests; high hill forests with longitudinal inter-mountain basins.

- Hydrography

The region presents a large hydrographic supply, represented in rivers such as Catatumbo, Sardinata, Nuevo Presidente, Socuavó Sur y Norte, Río de Oro, San Miguel, Tibú, along

with many smaller creeks, these form the Greater Bi-national Catatumbo Basin flowing into the Maracaibo Lake (Venezuela). See table below indicating major rivers in the project zone..

Table 4. Main Rivers in the Cacao Project Zone

Names	Basin Area (km^2)	Length (km)	Flow (m^3/s)	Coverage Flow ($lt/seg/km^2$)
Magdalena river	257.438	1.543	6.987	27
Catatumbo river 1/	16.000	110	278	66
Tibú river	349	55	45	58

1/ Characteristics in the Colombian area

The Catatumbo river originates in the eastern slopes of the Eastern Andes; 50% of its basin is in Colombia and the other 50% is in Venezuela. Main tributaries are the Zulia, Sardinata, Presidente, Tibú and Río de Oro rivers.

Sedimentation at Puerto Barco registers 3.3x106 ton/p.a. meaning 637/$km^{2/}$p.a.

Biotic characteristics[2]

- Flora

Flora is the most important environmental component, protecting soil against erosion, regulating river flow and providing habitats, food and living areas to wildlife.

According to the Leslie Holdridge (1996) classification, the zone of the study in Tibú corresponds to thermic basal floor, between 0 and 1,000 meters over the sea level, corresponding to the humid tropical forest (bh-T), with average temperature 24^o C, rainfall average between 400 and 4,000 mm.

The bs-T formation include diverse floristic species, there are three strata: trees, shrubs and pastures, well defined alternating with vines and low shrubs.

Tree height averages 20-40 m, shrubs vary between 7 to 12,. Thick low forest favors grasses and weeds under 1m high.
Floristic composition is varied, main species in the zone are Cedro (*Cedrela angustifolia*), Pata de gallina (*Didimopanax morototi*), Balso Blanco (*Heliocarpus popayanensis*), Guásimo colorado (*Luehea seemannii*), Niguito (*Miconia minutiflora*). Laurel (*Ocotea guianensis*), Cordoncillo (*Piper sp*), Achiote (*Bixa arellana*), Caracolí (*Anacardium*

[2] Documento de formulación Proyecto Cacao Norte de Santander
Estudio Bosques de Colombia IGAC.

excelsum), Yarumo (*Cecropia* sp), Ceiba (*Ceiba* sp), Nogal (*Cordia* sp), Cacao de monte (*Pachira aquatica*), alternating with grasses and weeds.

Weeds in the zone include: Cortadera, Caminador, Paja puya, Pajacomino, Varanegra, pega pega, Raspapingo, Cucubo, Escobilla y Raboalacrán,among others.

The source of information on forest composition was the Bosques de Colombia study. According to IGAC, the project zone comprises multiple use areas, cattle grazing and agriculture are predominant.

Forests areas in Tibú include:

- Tree areas: include large areas subject to anthropic intervention (deforestation), to establish agriculture and cattle grazing. However, there are some remaining forest relicts belonging to tropical humid forest (bh-T).

- Settlements and agricultural areas: include natural forests, partially intervened, to establish migratory crops, localized in the Andean foothills.

- Heterogeneous intervened forest: this is forests that have been slightly intervened , floristic composition is heterogeneous, stubble is predominant.

- River alluvial zones: natural vegetation has been intervened to make room for agriculture, including rice, cacao, plantain, and subsistence crops like cassava, beans, banana, and fruit trees; extensive cattle is also present in these zones.

- Crop areas: predominant crops include rice, cacao, plantain, oil palm, coconut palm, plantain, zapote and cassava, as well as illicit crops.

Plant coverings in the area of the study include:

- Intervened forests:

This include several vegetation strata, such as trees, shrubs, grasses and low-weeds. Tree tops reach 30-40 m high, trunk diameter exceeds 50 cm. Most woods are 5 to 25 m high. Predominant species include Anime (*Protium* sp), Caimo (*Pouteria* sp), Caracolí (*Anacardium excelsum*), Abarco (*Cariniana pyriformes*), Fresno (*Tapiria guianensis*) (ver Tabla 4. 2).

Another characteristic of this type of forest are vines of all kinds, creepers and ephifites growing on tree branches and trunks.

- Gallery forest

This type of forest grows along river banks, it is heavily intervened by man, include a few relicts not over 10 wide.

The gallery forest structure includes some trees, shrubs and grass. Some of the species growing along creek and river banks include: bamboo (*Bambusa guadua*), caña brava (*Gynerium sagittatum*), gramalote (*Paspallum dilatatum*) and iraka palm (*Carludovica palmata*) and grasses such as platanillo (*Heliconia* sp), bihao (*Calathea* sp), cordoncillo (*Piper* sp), Mastranto (*Hyptis* sp).

Species in the Project zone are included in table below.

Table 5. Forest Species in the Study Area[3]

Common Name	Scientific Name	Common Name	Scientific Name
Abarco	*Cariniana pyriformis*	Dinde	*Clorophora tinctoria*
Aceituno	*Vitex* sp	Escobillo	*Xylopia discreta*
Achote	*Bixa orellana*	Fique	*Agave americana*
Almendro	*Terminalia catapa*	Gramalote	*Paspallum* sp
Arrayancito	*Myrcia* sp	Granadillo	*Guarea* sp
Balsa	*Ochroma pyramidale*	Gualangay	*Jacaranda caucana*
Vine	*Davila* sp	Guayacán	*Bulnesia arborea*
Cacao	*Persea* sp	Bamboo	*Bambusa guadua*
Caña agria	*Costus* sp	Higueron	*Ficus* sp
Cañaguate	*Tabebuia* sp	Hobo	*Spondias mombin*
Carbonero	*Parkia* sp	Icaco	*Chrysobalanus icaco*
Cacao	*Ficus* sp	Laurel	*Ocotea* sp
Cordoncillo	*Piper* sp	Lemon	*Citrus lima*
Corn	*Zea mays*	African palm	*Elaeis guinensis*
Mango	*Mangifera indica*	Palma corozo	*Bactris gasipaes*
Marañon	*Anacardium occidentale*	Paw paw	*Ficus carica*
Payandé	*Pthecellobion* sp	Platanillo	*Heliconia* sp
Oak	*Tabebuia rosea*	Saman	*Pithecellobion saman*
Teak	*Tectona grandis*	Totumo	*Crescentia cujete*
Yarumo	*Cecropia* sp	Zarza	*Mimosa pellita*

- Fauna

There are several wildlife habitats, specially in gallery forests and others (see table below)

Fauna has been poorly managed in the project zone, deforestation and hunting have affected many species, endangered species include: birds, deer and cayman. The number of individuals are decreasing constantly (Rangel, 1087)

- Aquatic ecosystems

[3] García Barriga.1992, Flora medicinal de Colombia
Pérez Arbélaez..1978. Plantas útiles de Colombia.
Mahecha, G. 1995. Estudio dendrológico de Colombia
Rangel, O, Petter, L. & M. aguilar.1997

There are to distinct ecosystems in the area of the study: terrestrial, including natural and anthropic ecosystems as described above, and aquatic, represented by water bodies (rivers and creeks), abundant in fish. See table below.

Table 6. Fauna in the Area of the Study [4]

Common Name	Scientific Name	Common Name	Scientific Name
Mammals			
Squirrel	*Microsciurus sp*	Common mouse	*Mus musculus*
Puerco espín	*Coendou prehensiles*	Tinajo	*Dinomis branickii*
Curí	*Cavia porcellus*	Chiguiro	*Hydrochaeris hydrochaeris*
Boruga	*Agouti paca*	Armadillo	*Dasypus novemcinctus*
Sloth	*Bradypus infuscatus*	Ant eater	*Mirmecophaga tridactyla*
Wild pig	*Tayassu tajacu*	Deer	*Odocoileus vurginianus*
Mono aullador	*Allouata senuculus*	Ocelot	*Felix wedii*
Fara	*Didelphys marsupialis*	Ñeque	*Dasyprocta punctata*
Birds			
Garza	*Agamia agami*	Garcita	*Bulbucus ibis ibis*
Royal duck	*Anas sp*	Halcón	*Falco sp*
Cernicalo	*Falco sparverius*	Pava	*Penelope sp*
Paujil	*Crax sp*	Perdiz	*Colinus cristatus*
Zambullidor	*Heliornis fulica*	Guacamaya	*Ara macao*
Perico	*Aratinga sp*	Garrapatero	*Crotophaga ani*
Owl	*Bubo virginianus*	Colibri	*Phaethornis sp*
Barranquero	*Momotus momota*	Tucán	*Rhamphastos tucanus*
Viudita	*Fluvicola pica*	Tijereta	*Muscivora tyrannus*
Sparrow	*Notiochelidon sp*	Cucarachero	*Troglodytes aedon*
Toche	*Icterus chrysater*	Chirlobirlo	*Sturnella magna*
Reptilian			
Cazadora	*Philodrias viridissima*	Boa	*Constrictor constrictor*
Rattler	*Crotalus durissus*	Berrugosa	*Lechesis muta muta*
Talla equis	*Bothrops atrox*	Coral	*Micrurus sp*
Iguana	*Iguana iguana*	Cayman	*Crocodylus intermedius*
Cayman	*Caiman crocodylus*	Turtle	Geochelone carbonaria
Frogs	Hyla sp	Toad	Bufo sp

[4] Chochran. O. M & C .J Goin : 1970 Frags of Colombia
Ayala. S.C. 1986. Saurios de Colombia
Cuervo, A. ; J.Hernandez & A. Cadena 1986. Lista actualizada de los mamíferos de Colombia
Eisemberg, J.F. 1989. Mammals of the Neotropics
Emmons L.H.1990. Neotropical rainforest Mammals
Hilty.SL. & R.W.L.Brown. 1986
Jaramillo. L. 1993. Aves de Colombia

Table 7. Fish in the Project Area[5]

Common Name	Scientific Name	Common Name	Scientific Name
Bocachico	*Prochilodus reticulatus*	Dentón	*Hoplias malabaricus*
Nicurro	*Pimelodus clarias*	Barbudo	*Pimelodus grosskopfi*
Bagre	*Pseudopimelodus fasciatum*	Mojarra	*Oreochromis niloticus*
Sábalo	*Tarpon sp*	Cachama	*Colossoma sp*

Socio-Cultural Characteristics

- Historical Background[6]

From time immemorial the Tibú region was inhabited by the Motilon Indian tribes. Deforestation in the region started in the 1920's, during the beginning of the oil exploitation and roads that were constructed to serve oil fields. Settlements extended later towards the Tibú Sierra, in the Catatumbo basin, displacing Indians from their lands. Tibú started as a small hamlet in 1945, part of the municipality of Cúcuta. A Committee Pro the Municipality of Tibú was organized in 1975, and the new municipality was enacted in 1977. The main economic activity in Tibú is oil.

- Demography and Population[7]

The Catatumbo River basin coincide with old oil fields that spurred human occupation and unequal development. Spontaneous *campesino* settlements sprouted all over the region. Small settlers account for 40% of population, including INCORA beneficiaries that arrived in the zone some 30 years ago.

Population growth is included in the following table.

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[5] ARIAS, P.A. 1986. Las ciénagas de Colombia

[6] EL ESPECTADOR – PRESIDENCIA DE LA REPUBLICA – MINISTERIO DE EDUCACION NACIONAL. Así es Colombia. Los Municipios. Agosto-Diciembre 1995.

ALCALDIA DE TIBU. (1.998-2.000). PLAN DE DESARROLLO MUNICIPAL DE TIBU. Tibú

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[7] DANE. XVI Censo Nacional de Población y V de Vivienda. 1993.

DANE. Colombia. Proyecciones Municipales de Población por Área, 1995-2005. Estudios Censales. Santafé de Bogotá. Septiembre de 1998.

DANE. Estádísticas Municipales de Colombia 1991. Santafé de Bogotá. Abril de 1994.

DANE. División Político-Administrativa de Colombia. Julio de 1997

DANE. Los grupos étnicos de Colombia en el Censo de 1993 – Resultados- Bogotá, Noviembre de 1999.

DANE. Colombia Estádística 1993-1997. Bogotá, Febrero de 1999.

Table 8. Municipality of Tibú. Population Projections 1993-2000-2005

YEAR	TOTAL	Municipal Capital	Rest of the Municipality
1994	38217	11260	26957
1995	38291	11544	26747
1996	38596	11768	26828
1997	38897	11993	26904
1998	39185	12216	26969
1999	39435	12430	27005
2000	39648	12632	27016
2001	39827	12826	27001
2002	39977	13011	26966
2003	40091	13186	26905
2004	40161	13346	26815
2005	40182	13491	26691

Source: DANE Projections, 2001

The Catatumbo and Motilones-Perijá regions present serious problems related to land use. The entire left bank of the Catatumbo river is part of the forest reservation or the Indian Resguardo or the Motilones National Park. Old and new *campesino* settlements are located in this zone, as well as coca illicit crops.

Oil fields are predominant in the Catatumbo river basin, oil is the most important economic activity, unequal regional development and social conflicts are common in the region.

The Indian population in the region belong to the Motilon-Bari tribes, including 480 families (2,600 pop.) in 17 communities.

Public Service Infrastructure[8]

- Water and Sewer

Water and sewer services cover 98% of the urban sector in Tibú. A sewage treatment plant was recently inaugurated, raw sewage is not longer dumped in the Tibú river.

Public utilities in other urban areas are critical, there are few water services available, albeit water is untreated. Water coverage in rural areas is 55.4%, sewerage coverage is 35.9%.

The first phase of the urban aqueduct in La Gabarra, the largest urban center after Tibú, was completed, with PLANTE matching funds.

[8] Plan de Ordenamiento Territorial. Municipio de Tibú
Documento Formulación Proyectos Cacao Norte de Santander

- Electricity and telephone service

Electricity and telephone service in Tibú and La Gabarra is good, 1,200 people have telephone connection, and 194 in the rural areas.. In the rural areas, 62% of the population do not have electricity. Telephone rural service is available in public telephone cabins in the *corregimientos* and some *veredas.*

Table below indicates public service coverage

Table 9. Domestic Electric, Water and Sewer Coverage in the Municipality of Tibú (%)

	Electricity	Aqueduct	Sewer	No service or inadequate sanitary service
TOTAL	56,49	55,43	35,92	62,07
Municipal Capital	95,16	94,42	74,39	24,39
Rest of the municipality	36,92	35,71	16,46	81,64

Source: DANE Estudio de los Municipios de Colombia, 2001

- Domestic Gas Service

Domestic gas service is installed in oil workers homes, ECOPETROL, the national oil company, extended gas coverage, all urban homes are expected to be connected to gas lines in 2003.

In the rural areas, homes along gas lines have access to service albeit in high risk conditions.

- Slaughter house

The Municipal Administration began construction of a module to serve buyers and seller of meat products, under the patronage of the Fundacion Catatumbo. This systems may be extended to other urban centers in the region.

- Education

There are four education nuclei operating in four zones, including 163 primary schools (6 in urban areas, 157 in rural areas), 4 private elementary schools, 6 nurseries, 7 high schools (1 urban, 6 rural) and 1 private high school, 1 seminary, 1 Institute of Non Formal education, Secretarial and Systems. 1 extension of the University Francisco de Paula Santander and 1 of the Universidad Santo Tomás de Aquino. The number of students attending school is 12,697, there are 496 teachers.

Table 10. School Attendance by Sex and groups, in the municipality of Tibú

	TOTAL	MALES	FEMALES
Attending population 7-11 year-olds	61,39	60,20	62,70
Attending population 12-17 year-olds	49,41	47,50	51,50

Source: DANE Estudio de los Municipios de Colombia, 2001

- Health

There is one first level hospital that depends administratively from the Hospital Erasmo Meoz de San José de Cúcuta; two Health centers in Campo Dos y La Gabarra; 15 Puestos de Salud; one mobile unit and 19 first aid centers.

The Health Sectional Service renders anti-malarial epidemiological assistance in urban and rural areas.

- Housing

Distribution, status and housing characteristics in urban and rural areas in the municipality of Tibú are shown in table below, represented as Unsatisfied Basic Need (NBI) the Colombian indicador

Table 11. Homes with NBI Housing Indicators in the Municipality of Tibú

	Percentages	Inadequate characteristics	Lack of public Services	Critical overcrowding
TOTAL	34,7	34,7	33,0	19,2
Municipal Capital	33,0	11,8	14,4	8,4
Rest of the municipality	19,2	46,6	42,6	24,8

Source: DANE Estudio de los Municipios de Colombia, 2001

A new housing improvement Project is under construction Irving 60 families in the Llano Grande *vereda*, near Campo Dos, financed by the Red de Solidaridad Social and the municipality of Tibú, through a contract with Banco Agrario. A similar project is planned in La Gabarra, albeit insecure conditions have hinder construction.

- Transportation

Road networks in the municipality OF Tibú are shown in table below.

Table 12. Road Inventory in the Project Area of Influence, Municipality of Tibú

Road	Longitude (Km)	Status
TIBÚ – CÚCUTA	109	Pavement if poor state of conservation
TIBÚ – EL TARRA	78	Pavement if fair state of conservation.
TIBÚ – LA GABARRA	57	Unpaved, poor state.
TIBÚ – ORÚ	22	Pavement in good state of conservation.
ORÚ – PACHELLY	15	Unpaved, poor state.
LA GABARRA – RÍO DE ORO	35	Unpaved, poor state.
LA GABARRA – CAÑO TOMAS	42	Unpaved, poor state.
MIRADOR – VERSALLES	47	Under construction

Two roads serving the oil fields are in bad state of conservation and maintenance. Transit during the rainy season is extremely difficult.

Air transportation is sporadic, service is provided in small aircraft, belonging to ECOPETROL. River transportation is massive in the northern zone from la Gabarra. The Cataumbo river is the main fluvial artery in the region, 80 km are navigable. The rio de Oro is also navigable in a 45 km sector.

Land transportation is widely used, inter-municipal passenger service is provided in Tibú, La Gabarra and El Tarra by Copetrán, Peralonso y Trasan S.A. La Gabarra and El Tarra. There are other bus and taxi services available.

- Institutional Presence

Several public and private institutions are operating in Tibú, such as NGOs, community and cooperative associations, the municipal Mayor's office, UMATA, ECOPETROL, USO, CORPONOR; Parque Natural Nacional Catatumbo Barí, SENA, INCORA, FEDECACAO, ICA, CORPOICA, ICBF, Army and National Police, Red Cross, the Tibú Diocesis, SEM (Malaria Eradication Service), Hospital San José de Tibú, CENS (Centrales Eléctricas de N. S.) TELECOM, Universidades Francisco de Paula Santander and Santo Tomás de Aquino, ANMUCIC, ANUC, EFA, two Juzgados Promiscuos Municipales, Fundación Catatumbo, Community Action Boards, Banco Agrario de Colombia, high school institutes, Non-formal education institutes (secretarial, systems), the Labor office, SALUDCOOP IPS, EPS, medical centers, Insurance companies, transport cooperatives and ASOCBARÍ.

Socioeconomic Characteristics[9]

The main economic activity in Tibú is commerce, followed by oil and related services, agriculture, cattle and forestry (extraction of woods from natural forests). The cattle business is in crisis on account of rampant extortion by illegal armed groups..

Cacao is the main agricultural activity, 1,532 tons are produced annually. There are 72,000 ha of natural forests, 25,560 ha of intervened forests and 200 ha of forests under formation in the municipality of Tibú, and 22,000 ha of soils apt for intensive agricultural use (category II and II, flat and slightly undulated soils), and 60,842 ha of natural and imported pastures. The rest of the territory belongs to the Motilon-Bari Indian Reserve and the Catatumbo-Bari National Park.

- Agrarian Sub-sector Inventory

The following tables illustrate the crop inventory in the municipality of Tibú.

Table 13. Transitory Crops in the municipality of Tibú

CROP	Planted Area (ha.)	Production (ton.)	Yield (kg/ha)
Rice	983	5.222	5.312
Corn	450	360	800
Cassava	2.350	11.750	5.000
Sorghum	120	240	2.000

Table 14. Permanent Crops in the municipality of Tibú

CROP	Planted Area (ha.)	Production (ton.)	Yield (kg/ha)
Cacao	3.695	1.119	303
Coffee	106	130	1.226
Plantain	1.190	3.710	3.117
Sugar cane	85	382	4.494

Except for rice, transitory crops have diminished in Tibú because of poor management and pest ands insect infestation, as well as endemic disease such as Black Sigatoka, a plantain and banana disease, (*Mycosphaerela fijiensis, var. difformis*), that devastated plantations. This forced farmers to import plantain and banana from other regions in Colombia and Venezuela. Cacao Pests such as (*Moniliophthora roreri Cif et par.*) and brown cob rotting (*Phytophthora palmívora Butl.*) cause decrease in cacao production (150-200 kg/ha./year).

- Cattle and Fowl Sub-sector Inventory

Table below indicates the cattle inventory in the municipality of Tibú.

[9] Documento Formulación Proyecto Cacao Norte de Santander.

Table 15. Cattle and Fowl Sub-sector Inventory, municipality of Tibú

SPECIES	INDICATOR	1993	1996	1998
Bovine	No. heads	36.000	N.D.	15.500
Porcine	No. heads	N.D.	30.300	6.000
Equine	No. heads	N.D.	3.550	6.200
Mule	No. heads	N.D.	1.000	2.400
Ass	No. heads	N.D.	1.550	600
Fish culture	Ponds	N.D.	78	135

The bovine sub-sector has been hard-hit by insecurity in the region, this caused exodus of medium- and large-size owners, that left the region taking along stock and stopping investment in agriculture and cattle in the region.

- Mining Sub-Sector Oil Inventory

There are rich unexploited coal deposits in Tibú, especially in the Northern La Gabarra region. A few coal mines exist in the South exploited manually. Oil fields in Tibú are operated by ECOPETROL.

Social Conflicts

Potential project beneficiaries in Tibú live in four zones: Tibú, Dos Campos, Pacelli and La Gabarra, in 47 *veredas* of 142 *veredas* in the municipality. Total population in the *veredas* is 7,896 persons or 1,396 families.

Insecurity is the most pressing issue in Tibú. There are many illegal armed groups, as well as drug dealers and buyers that have caused confrontations with the civil population, Human Right violations an contribute to deterioration of productive activities.

Coca plantations are abundant in La Gabarra, coca is spreading fast in all the region, affecting the living standards of everyone, agricultural and cattle activities, the cost of staples and goods, labor shortages, in addition to other social problems like prostitution, gambling, school desertion and disintegration of families. People often leave licit jobs to earn more money in illicit activities, undermining the economy of the region.

In response to these issues, the Asamblea Catatumbo, Paz y Desarrollo was created with the participation of the civil society, NGOs, regional public and private institutions, under the leadership of the Mayor's Office and the Tibú Diocese, to discuss and agree on alternatives to overcome the regional crisis.

4.2.4 Cacao Project, Sur de Bolivar

Physical Characteristics[10]

- Location

The specific area of the sub-project is located in the Magdalena Medio sub-region (Sur de Bolivar), on the left bank of the Magdalena river and the San Lucas Sierra, including the municipalities of Arenal, Cantagallo, Morales, Río Viejo, Simití, San Pablo and Santa Rosa del Sur. The land is mostly flat near to the Magdalena river, intense fishing activities carried out in the river. The zone is classified as tropical humid forest .

- Climate

The temperature in the specific project zone fluctuates beween 25 and 36^{o} C, annual rainfall between 1,500 and 2,000 mm, relative humidity between 70-80%, wind speed 40-90 km/hour and sunshine between 2,000 to 2,5000 hour/year.

- Hydrography

The physiography of the region is characterized by the Magdalena river basin. The tributaries of the Magdalena are: the Tamar, Cimitarra, San Juan, Santo Domingo, La Concepción and Sepultura rivers. The Río Boque, originating in Alto del Tamar, has tributaries like the Tigüita, María, La Inanea and San Blas creeks. To the North of Simití are the Tigrecita, La Fría, Honda and Norosí creeks that flow into the Brazos de Morales and Papayal.

Other rivers in the zone are the Cimitarra, Morales, Simití, Santo Domingo, Boque, and swamps: Simití, Vija, Morrocoy, Victoria, Simoa, etc., and many creeks. River transportation is important to the region's economy, as well as source of fishing activity.

- Geomorphology

The zone geographical location contributes to the hydrographic and pluviometric regime of Sur de Bolivar, and the existence of a lake system that floods during the rainy season.

- Soils

70% of soils are clay, pH is 4-6, with 55% stones and gravel, moderate drainage, the level of the water table is under 2 m and slopes are under 25%.

[10] - Documentos de formulación de los Proyectos de Caucho Natural y Cacao el Sur Bolívar.
- Planes de Ordenamiento Territorial de los Municipios del Sur de Bolívar

Biotic Characteristics [11]

- Flora

The seven municipalities in the project zone correspond to the humid tropical forest (bh-T), According to the Leslie Holdridge (1996) classification. Flora has been subject to heavy antrophic intervention. Plant covering in the zone are:

- Types of vegetation

Natural Forest, intervened: located in the zone of terraces, not apt for cultivation. Composition is heterogeneous, characterized by many species and low individual representation. Tree tops reach 25 m high, there are shrub and grass species at the medium and low levels.

High and low stubble: this type correspond to secondary forest, of low commercial importance avoiding deforestation, individuals are rather short, in disperse areas, associated with changes in the use of soil and rotation of grass lands and abandoned crops. Individuals reach 2, 5 and even up to 15 m high.

Grass: Associated with extensive cattle raising, native or imported like brachiaria (*Brachiaria plantaginea*), pangola, and elephant grass (*Pennisetum purpureum*). Natural grass are found in abandoned grazing sites and stubble. Some varieties of native grass are: gramalote (*Hymenachne amplexicaulis*), cubillo, churry, cocúa, panceburro, canutillo and jindaca.

Swamp vegetation: found in flooding areas and associated with ponds and swamps, like palma de vino, associated with guarumo, varasanta, guácimo, hobo and native grass.

Crops: include cash and sustenance crops, corn, cacao, plantain, fruit trees, rice and cassava. There are large-scale crops like African palm oil, and illicit crops (coca)

The table below indicates plant species in the project area of influence.

[11] - Documentos de formulación Subproyecto Caucho Natural y Cacao para el Sur de Bolívar.
- Estudio Bosques de Colombia – IGAC
- García Barriga, Flora Medicinal de Colombia, 1992.
- Cuervo A, et al, Lista actualizada de Aves de Colombia, 1993.
- Jaramillo L, Aves de Colombia, 1.995.

Table 16. Forestry Species in the Area on Influence of the Project[12]

Common Name	Scientific Name	Common Name	Scientific Name
Anime	*Protium sp*	*Varasanta*	Tripalis Americana
Caimito	*Pouteria sp*	Yarumo	Cacropia sp
Campano	*Enterolobium sp*	Hobo	*Spondias mombin*
Cantagallo	*Eritrina glauca*	Jigua	*Nectandra sp*
Ceiba	*Ceiba pentandra*	Laurel	*Aniba perutilis*
Guásimo	*Guazuma ulmifolia*	Roble	*Tabebuia sp*
Gualanday	*Jacaranda sp*	Totumo	*Crescentis cujeta*
Higueron	*Ficus sp*		

- Fauna

The variety of habitats in the zone facilitates the presence of many species, specially wildlife associated to swamps and humid areas. Manatee, ponches (*Hydrochaeris hidrochaeris*), cayman (*Caimán crocodilus*), turtles and fish area abundant in the zone.

Fauna associated with land ecosystems depends on the degree of connectivity in the various plant coverings, including aquatic systems. Anthropic intervention is high in the area of the study. Wildlife survival depends on the capacity of the species to adapt to open spaces, urban areas or forest fringes. Following is a list of common species in the zone.

Mammals: Zaíno- a wild pig-, (*Tayassu tajacu*), guarnitaja (*Agouti paca*), ñeque (*Dasyprocta punctata*), armadillo (*Dasypus novemcinctus*), are extensively hunted for food, diminishing the numbers. Other species reported in the zone include monkey, marimonda, spider monkey, red monkey, ant eater, sloth, fox, otter, ocelot, pecari, deer, guarnitaja, mouse, squirrel, tapir and bat[13].

Birds: Most birds in the project zone are associated with water bodies, some common species include: viudita, gallito de ciénaga, parrots, guacamayas, cernícalo, hawks, tinguas, coclí, cocinera, pato yuyo, garzas, storks, ibis, ducks, Chavarri, gavilán, fishing eagles, tick eaters, guacharaca, paujil, tinguas, Australian parraket, martín pescador, cardinals, swalows, owls, monjita, sinsote, mirlo, toche, bluebirds etc.[14]

Reptiles: Babillas, cayman, boa, mapaná, false coral, boquidorada, rattlers, coral, iguana, chamaleon, lobito, lobo, turtle.[15]

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12 García Barriga.1992, Flora medicinal de Colombia
Pérez Arbélaez..1978. Plantas útiles de Colombia.
Mahecha, G. 1995. Estudio dedrológico de Colombia
Rangel, O, Petter, L. & M. aguilar.1997. Colombia Diversidad biótica II

13 (Cuervo, A. ; J.Hernandez & A. Cadena 1986, Eisemberg, J.F. 1989, Emmons L.H.1990

14 (Olivares. A. 1973, Hilty.SL. & R.W.L.Brown. 1986, Jaramillo. L. 1993)

15 (Ayala. S.C. 1986, Chochran. O. M & C .J Goin : 1970,

- Aquatic ecosystems

Swamp systems are found in the project zone, some are: El Limón, Enea, El Piñal, Saboréate, El Mesón and Congal. Swamps play an important role in controlling water levels during flooding of the Magdalena river.

These aquatic ecosystems are also important regulators of hydrologic cycles, human (antrophic) intervention is damaging swamps, reducing the flood plains, polluting waters by dumping raw sewage, trash, solid waste, and extracting unlimited supply of water for irrigation.

Swamps are natural habitats for many birds, permanent and migratory, fish and small mammals. Lotus and other floating floral species live in swamps, associated to slow water flow, high ñevel of decomposition of organic material and low oxygen concentrations.
The Magdalena river ictiofauna correspond to species typical of low lands, many are of commercial importance. Some commercial fish species are: pácora, mojarra amarilla, moncholo, bocachico, nicuro, capaz, blanquillo, doncella and cat fish. (Arias, P.A. 1986).

Socio-cultural Characteristics

- Historical background[16]

The municipality of Simití is located in a peninsula in a swamp formed by the Magdalena river. The city of San Antonio de Padua del Toro, was founded by Antonio de Lebrija, on April 1, 1537.

The municipality of Santa Rosa del Sur, is located in the San Lucas sierra. Founded in 1540.

The municipality of San Pablo was founded in 1770; it was the center of extensive agricultural production.

The municipality of Arenal was created in May 16, 1996. The territory was segregated from the municipality of Morales.

The municipality of Cantagallo was created in 1994.

The municipality of Río Viejo was founded in 1750. It became a municipality in 1982.

- Demography and Population[17]

[16] - Mineducación: Así es Colombia. 1.995.
- Gran Atlas Geográfico de Colombia, IGAC.
- Planes de Ordenamiento Territorial de los Municipios

[17] - Colombia, Proyecciones Municipales de población por Area, 1.995 – 2.005 – DANE.
Estudios Censales, 1.998 – DANE

According to DANE, the population of the department of Bolivar is 1,927,604 inhabitants, 44.07% live in Cartagena, 68.79% live in urban areas and 31.21% in rural areas. Age distribution indicates that the larger population age range is between 15 and 49 years-old, as follows:

Table 17. Population by Age Groups, Department of Bolivar

Age Groups (years)	Participation %
< 4 years	21,6
5 –14	20,4
15 – 49	49,7
50 – 69	5,6
> 70	2,7
TOTAL	100

- Statistical data, department of Bolivar

Human development index (IDH)0.63 - 0.70, 1985-1994
Population, Magdalena Medio: 152,886
Area, Magdalena Medio: 9,638 km^2
Population density: 15.9 habitants/Km^2
NBI housing index: Río Viejo 73.8, 1993; 50,9%, 1993; Santa Rosa del Sur 48,2%, 1993.
Overcrowding: San Pablo 41,6% in 1985, down to 18,8% in 1993

- Public Service Infrastructure

According to DANE, the life indicators in the municipalities of Santa Rosa del Sur, San Pablo and Simití, are as follows:

Table 18. Life Indicators, Sur de Bolívar

COMPONENTS	SAN PABLO		SANTA ROSA		SIMITI		%	
	Global	Rural	Global	Rural	Global	Rural	Global	Rural
Inadequate housing	52,4	63,9	48,3	61,5	50,9	60	50,53	61
Inadequate services	44,4	53,2	37,5	4,3	47	47,8	42,96	35,1
Overcrowding	18,8	18,2	33,9	3,9	26,8	30,8	26,5	17,63
Schools	17,1	18,8	13,8	16,2	11,9	14,6	14,26	16,53
High economic dependency.	22,9	20,5	15,4	15,2	20,3	21,9	19,53	19,2
NBI overall	73,4	80,8	73,2	84,7	77	83,6	74,53	83,03
Extreme poverty	50,9	59,9	47,5	59,4	50,3	50,3	49,56	56,53

80.2% percent of homes have access to public services, 69.3% to water, and only 47.8% have sewerage connection. Six people live in 43% of homes.

- Education

Estadísticas Municipales de Colombia, 1.994, DANE.

Pre-schooling education is a privilege for children living in municipal capital cities. Primary and high schools are usually found in the city. Children and adolescents in small hamlets –*veredas*- may finish the fifth grade of elementary school, chances of moving to the city to finish high school are scant. Youngster are attracted to the illicit economy or join subversive groups for lack of anything else to do and few, if any, licit jobs.

Vocational agriculture schools are located in the municipalities of San Pablo, Simití and Morales, also commerce schools. There are no institutions of higher learning. Education at distance is available in some locations.

The municipality of Santa Rosa has the largest rural primary school, 79%, followed by Rio Viejo 64%, Morales 61%, San Pablo and Cantagallo 60%, and Simití 56%.

Agricultural and stock raising training is available at Simití, San Pablo, Santa Rosa y Morales. Girls attend school more than boys, 84.7%

- Health

There is no good health services in the region, no specialists, no infrastructure. Emergency room are unable to attend serious cases, firearm wounds, explosion victim are sent to hospitals in Bucaramanga, Barrancabermeja and Aguachica. Total prepaid or subsidized medical is not available. The National Health Service (Seguro Social, ISS) does not have medical attention in Sur de Bolivar, patients must travel to Santander or Cesar. There are many health centers in the region though, that occasionally render medical and dentistry consultation services when health brigades visit the rural areas.

Preventive medicine services are provided by health promoters. There are 15 health centers in the region, including the Simiti hospital classified as II Level. There are 35 hospital beds for a population of 142,245 persons. An average of 18,000 medical and 245 dentistry consultations are rendered annually.

The most common diseases are acute respiratory infections, 18.1%, acute diarrhoea 11.2% and hypertension 8.3%. The principal causes of adult mortality are hypertension and violent death. Infant mortality causes are IRA, and EDA. Mortality in the 1-4 year-olds range is often caused by EDA (11.4/100,000 persons), along with pneumonia, bronchitis and asthma, followed by heart and nervous system congenital anomalies. Cervical and breast cancer and malignant tumours present high mortality rates. 60 year-olds and over ususlly die of cardiovascular and cerebral vascular disease.

- Transport

Fluvial cargo transportation is vital to the region, trade and commerce is done by river boats to the departments of Cesar and Santander. A tertiary road network connect the municipalities of Simití, Santa Rosa y San Pablo; another network, under construction, will

connect the municipalities of San Pablo, Cantagallo, Yondó (Antioquia) and Barrancabermeja (Santander). Rural road in the region are in bad state, maintenance is very poor. Roads are practically impassable during the rainy season, fluvial transportation is the only option available. San Pablo, Simití, Cantagallo, Río Viejo y Morales have river docking facilities. Passengers usually travel in canoes or rapid boats, cargo is transported in tugboats and ferries, such as the San Pablo- Curumuta y Cerro de Burgo – Gamarra, ferry systems.

The Santa Rosa municipality has air transport, provided by small aircraft. Flight from Santa Rosa connect with Puerto Wilches, Barrancabermeja and Bucaramanga. TAS has two and three daily flights out of Santa Rosa, except Sundays.

- Institutional Presence

Development programs are carried out in Bolivar by national and international development agencies such as the ministry of Agriculture and Rural Development, the Secretary of Agriculture, UMATA's, PLANTE, CORPOICA, PRONATTA, ICA, Corporación del Magdalena, PNDA, United Nations, CIRAD, USAID and financial entities.

- Community Organizations

The following organizations have offices and render services in Sur de Bolivar:

1. Cooperativa de Producción y Comercialización Agrícola de El Patico (COOPATICO LTDA). Cuenta con 64 socios.
2. Cooperativa de Pescadores de Servicios Múltiples: cuenta con 62 socios.
3. Asociación de Productores Agropecuarios del corregimiento de Cobadillo ASOPRADECO: Cuenta con 30 socios.
4. Cooperativa Agroindustrial y Pesquera Limitada de Río Viejo COAGROINPES: Cuenta con 16 socios.
5. Asociación de Productores Lecheros de Morales. cuenta con 160 socios.
6. Asociación de Pequeños Productores de Micoahumado (ASOPROMIC): Tiene 35 socios.
7. Asociación de Pequeños Productores Agropecuarios de Morales “ASOPEPAM”: Cuenta con 220 socios.
8. Asociación de Productores Agrícolas de La Bonita “ASOPABON”: Cuenta con 40 socios.
9. Fundación para el Desarrollo Sostenible para el Sur de Bolívar
10. Asociación de Pequeños Productores de Frijol Calima “ASOCALIMA”: Cuenta con 111 socios.
11. Asociación de Cañicultores corregimiento Villa Flor; cuenta con 54 socios.
12. Asociación de Agricultores de San Joaquín

13. Cooperativa Multiactiva de Pescadores de San Pablo "CONSULPESC LTDA": Cuenta con 45 Socios.
14. Asociación de Desarrollo Empresarial Agroindustrial y Minero de Colombia ADEMAC: Cuenta con 25 socios.
15. Asociación de Pequeños Productores Agropecuarios de San Pablo ASOPABLO. Cuenta con 60 socios.

Productive – Economic Characteristics[18]

- Agriculture

The Sur de Bolivar region has a small-farmers subsistence agricultural system in the high lands in the San Lucas Sierra. Farmers cultivate beans, corn, cassava, plantain and cacao. Very small quantities are left to take to markets after using these crops for family food. Beans is the most important crop.

The largest farms are located in the flat plains towards the Magdalena river, the sub-regional space is shared between subsistence crops and cattle.

The *campesino* and industrial agricultural secto occupies an area of 35,280 ha and 1,338 ha, respectively. The total agricultural area is 36,618 ha.

Sugar cane crops are found in Santa Rosa, 1,150 ha, 400 ha are planted and 698 ha are in production. ASOCAVILLA, theVilla Flor Sugar Cane Association, has 54 members. I n 1999, the farmers xpected to improve *panela* (hard brown sugar cakes) from 9.8 to 12 ton/ha, with the help of the PNDA regional technicians, the municipality and Asocavilla. Asocavilla owns a sugar mill that can produce 80 kg of *panela* per hour. The product is sold in regional markets.

In spite of existing appropriate conditions, cacao has only penetrated small areas in Sur de Bolivar. The reason for this is that cacao was introduced to the region at the same time that migrant cacao farmers arrived. These farmers new little about modern cacao farming, albeit they have been cultivating cacao for generations.

Some old cacao plantations, 20-30 years old, have been abandoned, some produce low-yield crops (250 – 300 kg/ha), most are improperly managed, pruning, phytosanitary control, shade management, are not carried out as it should. Many plants are sick with*monilia* and witches broom disease. Pest infestation levels are high due to improper fitosanitary management.

[18] - Documento de formulación de los Proyectos de Caucho y Cacao para el Sur de Bolívar.
Planes de ordenamiento Territorial de los Municipios del Sur de Bolívar.

In summary, the total cacao production in the 3 municipalities described above is abot 60 tons/year in 215 ha. This is quite low compared to the national cacao production, 36,000 tons/year.

Cacao grains are sold to bean and coffee buyers. Marketing is carried out at the Mico-ahumado (smoked monkey) and at the Santa Rosa markets. Cacao is trucked to Ocaña and Bucaramanga. The rice of cacao as of the date of this report, is COL$2,000/kg ($0.75/kg).

- Cattle

24.39% of the total arable land or 253,473 ha is being used for cattle raising. Cattle earnings increased in the past three years, due to better market prices. Bovines are predominant in the region, specially in humid tropical lands; more than 173,000 heads, according to URPA statistics, 1999.

Pigs and sheep are raised by small farmers. Fowl farming is increasing, in San Pablo, Simití and Santa Rosa there are several chicken farms producing between 500 – 5,000 chickens/year.

- Fish farming

There are not any fish farms in the region. Fishing is done in swamps, albeit the water in the reion swamps is contaminated by coca processing mills dumping waste in rivers and creeks that flow into the swamps, as well as by mercury used in mining activities.

- Mining

There is some small-scale alluvial gold mining activity in the municipalities of Simití, Santa Rosa del Sur, San Pablo, Montecristo, Cantagallo, Morales, Río Viejo y San Martín de Loba in the San Lucas Sierra. Mining potential is important in the Zona de Reserva Campesina Piloto, gold, oil and copper deposits have been identified.

- Illicit Crops

According to the SINCI's illicit crop monitoring system, about 4,824 ha coca crops are being cultivated in the department of Bolivar, as of November 2001. Coca fields vey in size from 1 to 20 ha.

Coca is a way of life in Sur the Bolivar given the extreme poverty of small local farmers. Migrant farmers also joined the coca train. NBI indicators are high, illiteracy and political violence contribute to coca as means of obtain incomes and breaking somewhat the poor living conditions of the *campesinos*, or so they think…

Coca also contributes to generate violence, there are many illegal armed groups that are engaged in the coca business. Most coca is cultivated in municipalities in Sur de Bolivar. Soe landowners use coca earnings to improve cattle activities, disguising illicit activities by laundering coca money.

Sur de Bolivar small farmers plant coca in parcels not over 3 ha. Some plantations are as large as 10 ha, although this is not the general case.

Distribution of coca crops, according to UMATA, is shown in table below.

Table 19. Coca Crops in Sur de Bolivar

MUNICIPALITIES	Large Producers Has	Small Producers Has	TOTAL Has
Simiti	2,000	3,000	5,000
Rio viejo	20	95	115
Morales	240	960	1,200
Santa Rosa del Sur	156	624	780
San Pablo	600	2,400	3,000
Cantagallo	150	350	500
Arenal	45	255	300
TOTAL	**3,211**	**7,684**	**10,895**

Coca is planted in hilly lands, the level of technology applied to coca crops is rather sophisticated. Coca yield in Sur the Bolivar are higher than in Guaviare, 200 arrobas may be harvested per hectare, while in Guaviare yields average 120/140 arrobas per hectare. Note: One arroba equals 25 kg.

Some farmers rent their land to coca traffickers. Some sell the leaves and others transform the leaves into coca paste. Intermediaries buy coca paste. Coca activities average about COL$1,000 million per week, about 40% remains in the region. Paradoxically, these large amounts do not seem to improve farmers living conditions, cattle or home improvements; many coca farmers squander easy cash in gambling and prostitution sites.

Coca workers earns about COL$10,000/day ($4.00/day), less than common wages (COL$8,000/day or $3.00). Coca leave scrapers, or *raspadores*, may earn twice that much. They, however, are the big spenders and live from day to day. The extra money is spent foolishly and the cost of living is rather high, they are not used to savings.[19]

PLANTE's Sur the Bolivar office estimates the following illicit crop substitution goals:

[19] Entrevista con técnicos UMATA

Table 20. Illicit Crop Substitution, Sur de Bolivar[20]

Municipality	Families	Veredas	Has of coca to be eradicated
Arenal	45	3	100
Morales	50	4	50
Río Viejo	30	3	30
San Pablo	40	3	40
Santa Rosa	80	4	150
Simiti	50	4	100
Canta Gallo	30	3	30
TOTAL	**325**	**21**	**500**

Social Conflicts

Sur de Bolivar accounts for the higher NBI ratings, including extreme poverty, illiteracy and political violence. Farmers and rural dwellers turn to coca and illegal forestry and mining activities to make a living. However, illegal activities do not help them in breaking poverty barriers.

PNR Councils provided space to discuss community issues, including municipal budgeting. Law 101 of 1993, Agriculture, Cattle and Fishing, replaced the councils and created the Rural Development Municipal Councils. However, exploitation and plundering of natural resources continue, threatening the environmental equilibrium of natural forests.

4.3 PERSUAP

4.3.1 Principal Findings and Recommendations

The Colombia Alternative Development (CAD) Program

The Colombia Alternative Development (CAD) program funded by USAID within Plan Colombia's context supports farmers, farmers' families and farming communities that have been so far involved in the production of illicit crops, such as coca and poppy, to voluntarily switch to licit crop production. Working with communities, community associations, and municipalities in the departments of Bolivar, Cauca, Caqueta, Huila, Nariño, Norte de Santander, Putumayo, and Tolima, CAD is creating licit economic opportunities that Hill generate income, improve the quality of life, protect the environment, and support ethnic and cultural values for peaceful coexistence. The program uses an open-bid approach to call for sustainable project proposals from farmers' organizations in support of basic staple crops ('*cultivos de pan cojer*') projects, as well as 'industrial' crops targeted to internal and/or external markets, that may be associated to industrial processing and transformation projects.

[20] FUENTE: PNDA, 2001

So far, most agricultural projects supported by CAD include low-input agricultural systems, ecologically appropriate, featuring integrated and ecological or organic approach to crop production and pest management. This is the case of cacao, where cacao growers association, Fedecacao, is promoting an ecological approach to crop production, closely related to organic production system (see "Pests in Cacao Farming and Management Guidelines" in table No. 26). This is the type of alternative development that, by protecting the health of Colombians and their environment, not only maximizes the potential of becoming sustainable in the long-term but also, but calls for diversification of production systems that improve production and minimize marketing risks.

Recommendation No. 1: CAD should continue with this eco- friendly approach to promote alternative crops, leading into sustainable development, to assist in benefiting the environment and health of participant farmers, their families and consumers.

4.3.2 Spread of Insect Pests and Crop Disease

CAD is actually taking crops from traditional cropping areas to new ones in the Colombian territory. Although, most of these crops are not really foreign to the country or to regions where CAD is operating, they have been grown, if at all, in a few locations.

Recommendation No. 2: In order to prevent dissemination of pathogen-contaminated crop seeds, insect pests, and weed spreading, CAD should establish a strict plant sanitation/quarantine system based on international and Instituto Colombiano Agropecuario (ICA) certification procedures and quarantines to control transportation of foreign plant materials into the country, as well as from one region to another within Colombia.

4.3.3 Present Pesticide Use

There is no clear evidence of abuse or misuse of pesticides in ongoing CAD-supported projects. Two standing issues, however, need to be mentioned. The first issue is the mentality of farmers participating in the alternative development program. Illicit crop farmers, such as those dealing with coca and poppy, are presently used to abundance of inputs to produce highly marketable and profitable illicit crops. Due to the extremely high prices paid for coca and poppy, the economic and action thresholds for pest control, as traditionally used in Integrated Pest Management (MIP) are so low, that they become a totally irrelevant tool for rationalization of pesticide use. As such, pesticides as well as other agricultural production inputs are used in large quantities, leading to abuse and misuse. This tendency, namely using pesticides as the main, or even the sole, tool for pest management is one of the major challenges to be surmounted by CAD in order to 'rationalize' pest management programs in alternative development crops.

The second issue is distribution of pesticides in Colombia. This is currently done through large- and medium-size distributors located in Bogotá, Cali, Medellín, and in other major

cities, all the way down to small-size pesticide dealers located closer to the final users. During the visits to pesticide distributors made by the consultants, we perceived that: (1) Colombian manufacturers and importers comply fully with international codes in regards to pesticide labeling and packaging; (2) the size and package of pesticides is adequate, as reported by final users; (3) stores visited look clean and organized; (4) no evidence was found of re-packaging of pesticides; and (5) store clerks have a relatively good level of knowledge about pesticides, their toxicity and labeling. A problem, although not directly observed by the team but heard of in the field, seems to be the illegal direct distribution of smuggled foreign-made pesticides, including products cancelled and prohibited in Colombia. Given widespread lack of security prevailing in rural areas where CAD operates, the capacity of Colombian authorities to y control the illegal traffic of pesticides, is scant.

In summary, due to an extremely favorable cost/benefit ratio derived from the use of pesticides in illicit crops, CAD farmers are over-using pesticides in crop farming activities, without the benefit of rigorous health or environmental analysis of risks related to use of pesticides. A great number of pesticides used in the field, are highly toxic and many are environmental hazards[21]. The well-controlled legal pesticide market is altered by illegal trading of foreign-made pesticides, difficult to control. These are major challenges faced by the Government of Colombia (GOC) and CAD, in promoting environmentally-oriented sustainable alternative development.

Recommendation No. 3: CAD should adopt program strategy in support of (a) project beneficiaries, to assist farmers and their families, in learning health hazards inherent to pesticide use; (b) project operators, civil society and government authorities to caution farmers, their families and rural Colombian communities aware of environmental hazards and social costs, of pesticide abuse and misuse; and (c) providing technical assistance to train operators in Safer Use of Pesticides (SUP) and Integrated Pest Management (MIP), based on the principles of economic injury and action levels and thresholds[22].

4.3.4 Pesticide Evaluation

Review of pesticides recommended by technical institutions and/or requested by project operators for cacao crop farming activities are included in tables, below. Most of these pesticides were cleared based on the review of the 12 points of *22 CFR 216.3(b)(1)*. However, some of them do not fully comply with USAID environmental requirements for development projects. Of the total, only 5 active ingredients were selected, to be further studied as possible pesticides to be used in the cacao crop pest management (see table No. 26). These pesticides were then subjected to the more complete 'risk analyses, discussed and shown in a table No. 29.

[21] More than 30 commercial pesticides are regularly used in Putumayo. Thirty percent of the local farmers use paraquat at least once a month and 14% regularly use metamidophos, among other products (US Embassy, 2001).

[22] IPM programs may use economic injury thresholds, e.g. when the population of a pest is such that the damage it causes is economically 'significant', and/or action thresholds, e.g. the population density or the damage level when the control should be applied to prevent the pest to reach its economic injury level.

<u>Recommendation No. 4</u>: Some of the pesticides being presently requested and or purchased by CAD operators are to be *phased out* following the subsequent timeline. (a) In order to allow time for the search of alternative products, preferably non-chemical, while still protecting the crops, the insecticides: carbofuran, chlorpyrifos, and profenofos, and the fungicides: chlorothalonil and copper oxychloride should be phased out in the medium term (1-1.5 years). (b) Due to higher than accepted health and environmental risks, and the availability of pest management alternatives to these molecules, the fungicides: benzimidazole, captafol, hexaconazole, kasugamicine and ofurace, and the insecticides: methomyl, cyfluthrin, cyalothrine (lambda) and cypermethrine should be phased out in the short term (0.5-1 year). (c) The highly toxic and easily replaceable insecticides: monocrotophos, metamidophos, aldicarb, isazophos, and methyl parathion and the herbicide: paraquat should be phase out immediately. (d) And finally, and additionally to this, no product listed in the prohibited pesticides category in the US or Colombia, should ever be used in this project .

4.3.5 Safer Use Practices

Colombia is one of the most advanced countries in Latin America in regard to pesticide registration, regulation and control, as well as in training in agronomy and associated disciplines. Colombia has very up to date registration procedures, applies international standards and codes for pesticide labeling and has a system to follow up and control pesticide manufacturers and distributors that is only limited by the insecurity situation that the country has been living during the past 25 years. The majority of Colombian technicians working in the areas of pest and pesticide management were found to have a solid knowledge and understanding of IPM and safer use of pesticide procedures. However, in spite of all these, there is still need and room for interventions on Safer Use of Pesticides (SUP). The majority of farmers in CAD areas of intervention do not use 'best practices' for SUP: less than 10% use some type of body protection when using these products and 70% of those directly exposed to pesticide spills do not do anything after the accident for clean up or decontamination (US Embassy, 2001).

<u>Recommendation No. 5:</u> Considering the traditional attitudes and practices of the participant farmers with respect to pesticides, as well as the limited GOC presence in the isolated, and conflictive, areas where CAD is operating, it is recommended that a strong SUP program be implemented. The program should (a) be based on the pre-existing training offer already available in Colombia; (b) attempt to raise 'awareness' of the health and environmental hazards of pesticides as well as to teach 'good practices' on SUP; and (c) go hand in hand with training in 'ecological agriculture' and IPM, so SUP does not become a false panacea.

4.3.6 Pest Management Approaches

The majority of the Colombian professional agronomists has been exposed to, trained in and has an understanding, if not a full knowledge of IPM. This has become, not only the 'official' approach to pest management at the state-government institutional level (ICA), but also it has taken root in para-statal (Corpoica) institutions, in charge of pest and pesticide R&D, as well as in private R&D organizations. This is the case of grower associations, such as Cenipalma, Cenicafé, Cenicaña, and Fedecacao. Moreover, Colombia is the headquarters for the well reputed CIAT, a centre for tropical agricultural research that has conducted pioneer research on IPM of insect pests and diseases in various crops, foremost among them cassava. Relevant to this PERSUAP, we highlight the availability of IPM programs for oil palm, cacao, plantain, sugar-cane, rice, and timber plantations.

As shown in the tables below, Colombia is well advanced in the production of bio-inputs for pest management, such as microbial pesticides, entomopathogen fungi, bacteria and viruses, as well as nematodes and parasitic wasps. These bio-inputs are produced and sold in the country by a variety of small, mainly national, industries (see tables below). The important issue, from an IPM perspective, is that these products become a readily available, much healthy an environmentally friendly option to the chemical pesticides. As per an expert entomologist and IPM practitioner, "Colombia is better positioned than the US for the supply of bio-pesticides to agriculture".[23]

Recommendation No. 6: CAD is encouraged to disseminate, among project operators, both of the below lists of bio-pesticides (Table 21) and enterprises producing bio-products (Table 22) in an effort to promote their use in substitution of the more toxic and environmentally hazardous chemical pesticides.

As per USAID Regulation 216 requirements, and as stated previously, in order not to transmit the false idea that pesticides, used safely, could be the sole solution to pest problems, SUP should not be promoted in isolation but rather in the context of a larger, more comprehensive approach to pest management, that of Integrated Pest Management, or IPM. Colombia is well ahead in IPM research and development as well as in IPM training. Additionally to the pesticide analysis, a considerable amount of effort in the preparation of this PERSUAP has been allocated to the development of IPM matrices that summarize the available tactics to manage the major crops pests and provide the user with additional references to the subject as well as main contacts for technical support and their Management in this section. This is to the benefit of the CAD project operators that can find in these tables guidance for the avoidance of the most toxic pesticides as well as non-chemical options for pest management.

Recommendation No. 7: In spite of the good technical level of the field technicians working within CAD and the CAD project operators, technical support in IPM should be strengthened. This may take the form of (a) crop specific field demonstrations on the use of non-chemical pest control methods; and (b) provision of support to the

[23] Dr. Anthony Bellotti, Cassava IPM Leader, CIAT, personal communication.

technical staff of the operators for training-of-trainers as well as for direct farmers training in crop-specific IPM programs.

Table 21. Main Biological Inputs Produced in Colombia*

Entomo-pathogen Fungi	Fungi Bio-fungicides	Parasitoids	Predators	Entomopatho-gen Bacteria	Entomopatho-gen Viruses
Beauveria bassiana	*Trichoderma harzianum*	*Trichogramma exigumm*	*Chrysoperla externa*	*Bacillus thuringiensis*	Nuclear Polyhydrosis Virus (NPV)
Metarhizium anisopliae	*T. lignorum*	*T. pretiosum*	-	-	*Baculovirus ello*
Paecilomyces fumosoroseus	*T. viridae*	*T. atopovirilia*	-	-	-
Nomuraea rilely	*Gliocadium spp.*	-	-	-	-
Paecilomyces lilacinus, minense	-	-	-	-	-
Verticillium lecanii	-	-	-	-	-

* Table courtesy of Dr. A. Bellotti, CIAT.

Table 22. Main Enterprises Producing Biological Inputs in Colombia*

Enterprise	Inputs = Organisms
Agricultura Biológica (Buga-Valle Del Cauca)	Entomopathogen fungi, Parasitoids, Predators, Bio-fungicides
Agrobiol (Buga-Valle del Cauca)	Parasitoids
Bioecológicos (Palmira-Valle del Cauca)	Entomopathogen fungi, Parasitoids, Predators, Bio-fertilisers
Biocontrol (Palmira-Valle del Cauca)	Entomopathogen fungi
Productos Biológicos Perkins (Palmira-Valle del Cauca)	Entomopathogen fungi, Parasitoids, Predators
Productos Biológicos El Bolo (Palmira-Valle del Cauca)	Parasitoids
Laverlam (Cali-Valle del Cauca)	Entomopathogen fungi and viruses
Orius (Villavicencio-Meta)	Entomopathogen fungi
Biogarden (Bogotá-Cundinamarca)	Entomopathogen fungi
Biocaribe (Medellín-Antioquía)	Entomopathogen fungi
Live System Technology-LST (Bogotá-Cundinamarca)	Entomopathogen fungi, Bio-fungicides

* *Table courtesy of Dr. A. Bellotti, CIAT*

4.3.7 CAD and Environmental Compliance

The CAD project, being implemented by Chemonics in Colombia, is in the process of establishing full compliance with USAID environmental regulations. Previous Initial Environmental Examinations (IEE) have been completed for the majority of the CAD activities, as per LAC-IEE-99-38 and LAC-IEE-00-35. A Programmatic Environmental Assessment (PEA) was completed for CAD and approved in June 2003. Among the activities required by USAID for CAD to regularise its environmental compliance was a full study of the pesticides used in the alternative crops being promoted. To this effect Chemonics International commissioned the present Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) focused on those crops that have been so far supported by the CAD program.

4.3.8 PERSUAP Objectives

This PERSUAP has been prepared to achieve the dual purpose of (a) complying with USAID environmental regulations, and (b) to provide the CAD project operators with practical tools for better and safer management of their crop pests. The PERSUAP not only analyses pest and pesticide issues in the crops so far supported by CAD but it also addresses the broader issues related to pest and pesticide management in CAD and in Colombia, such as GOC regulatory and institutional frameworks, the agro-ecology of the intervention areas, training and technical capacity strengthening, and provides guidelines for SUP and IPM as well as identifying offers for these type of programs in Colombia. Future commodities, pests and pesticide products to be considered under the CAD program implemented by Chemonics, but not covered in the present document.
During the preparation of the PERSUAP visits were made to Colombia pesticide authorities (ICA), and to major Colombian, and some international, technical institutions with a possible offer to pest management technology and training, such as Cenipalma, Fedecacao, IICA, Corpoica, Centro de Excelencia en Fitoprotección (Aphis, USDA, IICA, ICA, USAID), CONIF; to universities (Nacional) and training centres (SENA); to the private sector (Bayer CropScience, ANDI, BioEcológicos, SEG, pesticide dealers); and environmental consultant companies (Tres Elementos, CAEMA). Trips were made to Norte de Santander (Cúcuta) and Putumayo (Puerto Asís) where meetings were held with CAD project operators' technical staff and some visits made for field observations.

4.3.9 Pesticide Registration Statuses in Colombia and with US-EPA: 22 CFR 216.3 (b)(1)(i)(a)

Close to 55 pesticide active ingredients were screened for their registration status with the Colombian authority, the Instituto Colombiano Agropecuario (ICA)[24], and with US Environmental Protection Agency (USEPA)[25] This list of pesticides was compiled from

[24] For this, an updated "Chemical Pesticide, Bio-inputs and Generics" database was obtained courtesy of ICA authorities.
[25] For this, EPA databases were consulted at its web site.

that sent by CAD operators to Chemonics requesting purchase clearance, in June 2003, and other pesticides following the recommendations of Colombian state and private technical institutions[26].

Recommendation No. 8: The list of pesticides to be purchased by CAD operators should be screened by the CAD Natural Resources and Environment (NRE) team, based on the pesticide lists included in this PERSUAP. Pesticides not mentioned in this PERSUAP should be subjected to a screening process. Products not registered with Colombia-ICA and with US-EPA should not, in principle, be approved (see exceptions discussed below).

Recommendation No. 9: The summary of the pesticide analysis with the associated recommendation is:

- **Products not registered in the US and Colombia or in PIC[27] list. NOT TO BE USED UNDER ANY CIRCUMSTANCE: captafol, isazofol, methyl parathion and methamidophos.**
- **Products not yet registered in the US or Colombia. Although a microbial product, the first, and a plant extract, the second, they are NOT TO BE USED UNTIL REGISTERED in at least Colombia: *Baculovirus spodopterae* and *Swingla* (extracts).**
- **Products not registered in Colombia. NOT TO BE USED UNDER ANY CIRCUMSTANCE: endosulfan.**
- **Products not registered with USEPA. NOT TO BE USED UNDER ANY CIRCUMSTANCE: benzimidazole, hexaconazole, kasugamicine, monocrotophos, and ofurace.**
- **Products not registered w/USEPA. But registered in Colombia. APPROVED TO BE USED: extracts of *Glyricidia sepium*, because the resource (*Glyricidia*), the crop (vanilla) and the pest (*Cylsia*), are not present in the US; *Paecilomices liacinus*, because the crop (heart of palm) and the pest (*Leptopharsa*) are not present in the US and the pesticide is a microbial insecticide with unlikely environmental or health impact; and *Trichogramma pretiosum* and *Verticillium lecanii*, are both microbial insecticides with unlikely environmental or health impact.**
- **Products are RUP with USEPA. NOT TO BE USED: aldicarb, cyalothrine (lambda) cyfluthrin, chlorothalonil, chlorpyrifos, copper oxychloride, cypermethrine, methomyl, paraquat, profenofos**
- **Products are RUP[28] with USEPA. USE ONLY CERTAIN FORMULATIONS to reduce health or environmental risk: carbofuran (pellets/tablet), and picloram (Tordon 101R).**

[26] Sources for technical information were the official ICA or Corpoica, Colombia government recommendations, the growers associations or research centres, international research centres and literature references applicable to Colombian conditions, with solid technical and scientific background.

[27] 'PIC List' is the Prior Informed Consent List of the Rotterdam Convention, led by UNEP and FAO, that applies to the international shipment of the most hazardous chemicals.

[28] RUP: Restricted Use Pesticide.

The timeline for the implementation of these recommendations is given in Table 23.

Table 23: Summary of The Pesticides To Phase Out of CAD

To be phased out immediately:			To be phased out in 6-12 months		
Technical Name	**Trade Name**	**Uses**	**Technical Name**	**Trade Name**	**Uses**
Monocrotophos	Azodrin	Heart of palm	Benzimidazole	Benomyl+	Requested by operators
Methamidophos	Tamaron	Various crops	Captafol	Difolatan	Cassava
Aldicarb	Temik	Potato	Cyfluthrin	Bulldock	Requested by operators
Isazofos	Miral	Potato	Hexaconazole	Anvil	Requested by operators
Methyl-parathion	Methyl-parathion, etc.	Rice	Methomyl	Lannate	Requested by operators
Paraquat	Gramoxone	Various crops	Kasugamicine	Kasumin	Potato

To be phased out in 12-18 months			To be phased out in 6-12 months		
Technical Name	**Trade Name**	**Uses**	**Technical Name**	**Trade Name**	**Uses**
Carbofuran	Furadan	Cassava, Rubber, Plantain, Nurseries	Ofurace	Grolan	Requested by operators
Copper oxychloride	Agrotox	Cassava	Cyalothrine, lambda	Karate, Terminex	Potato
Chlorpyrifos	Lorsban	Plantain, Oil Palm, Cassava, Rubber, Forest Plantations	Cypermethrine	Saat Pop, Agroper, Cipermetrina	Rice
Profenofos	Curacron	Rubber	----------	----------	----------
Chlorothalonil	Bravo	Rubber	----------	----------	----------

4.3.10 Asis for Selecting the Pesticides: 22 Cfr 216.3 (b)(1)(i)(b)

The main reason for selecting these pesticides is that of availability, efficacy and cost. This is typically the case of products such as chlorpyrifos and carbofurán that, although both RUPs, they are some of the most effective, and cheapest, insecticides and nematicides, as well as preferred products for ant control.

A usually overlooked criterion in the selection of pesticides is that of the formulation. On one hand, a simple way to reduce exposure risk to certain pesticides, such as chlorpyrifos, is to switch to formulations, like granules or pellets, that are not subjected to dangerous spills and drift. The same may be applicable to the reduction of the environmental impact of certain pesticides, such as the herbicide picloram, that by using injections to the bushy weeds, as opposed to sprays, there is a reduction on the total volume used and on the area impacted. Care must be exercised, however, because a granular or pellet formulation, being more attractive to them, could be more toxic to birds. So, the potential health and

environmental impact of the various possible formulations from which to choose should always be considered, checked and analyzed when selecting a pesticide.

<u>Recommendation No. 10</u>*:* CAD should implement training and capacity development in SUP for the technical staff of the operators including the theme of pesticide selection. Variables such as product toxicity (using the color-coded labels), potential environmental impact, and the formulation are to be used among the criteria for selecting pesticides, additionally to efficacy, availability and cost.

4.3.11 Pesticides in the context of integrated pest management programs: 22 CFR 216.3 (b)(1)(i)(c)

"Integrated pest management" is USAID policy because it is the most effective, economical, and safest approach to pest control. IPM attempts to control pests in an economically and environmentally rational manner; it emphasizes non-chemical tactics which cause minimal disruption of the ecosystem"[29]. Pesticides should be used as the last resource for pest management after all other options have proven ineffective. Genetic (plants tolerance or resistance), biological (natural enemies), ethological (naturally occurring chemical disrupters), cultural (production practices), and mechanical (physical removal) are all preferred tactics to be used before resorting to chemical control (pesticides).

The general introduction on IPM possibilities for cacao crop is shown in Table No. 26; the list of various possible pest problems of the crop, the management options available, the specific pesticides for the pest and some of the potential problems with the control options discussed. Finally, they list some technical support offers at the level of institutions and individuals and sources of information such as literature references and web sites.

<u>Recommendation No. 11:</u> No crop should be promoted without first establishing an IPM program. CAD should install at least one crop specific IPM demonstration field in each of the intervention areas. To this effect CAD should work with the local UMATAS (Municipal Agronomic Technical Assistance Unit) and request the technical support of the institutions and individuals listed in the pest management offers.

4.3.12 Method of Application: 22 Cfr 216.3 (b)(1)(i)(d)

Although a few of the farmers may have access to stationary-pump spraying systems, somehow common in illicit crop growing areas, most of the pesticide application will happen through back pack sprayers. A common situation with these sprayers is that (a) they are not properly maintained and so they often leak with significant increases in the exposure of the applicator to pesticides, and/or (b) they are not properly set for the job with nozzles that are not the most appropriate for the particular type of pesticides (insecticides-

[29] *USAID/AFR Guidance: Preparing PERSUAPs for Pesticide Programs in Africa.*

fungicides or herbicides) being sprayed. Pesticide mixing is also an issue since often farmers do not follow all the precautionary measures and the concentrated, undiluted, pesticide increases the risk of the exposure. Commonly, in some rural areas, women and children may dangerously participate or stay close to the mixing, spraying and cleaning of the pesticide spray equipment. Finally, cleaning and disposing of pesticide excesses and of the product container needs to follow strict norms in order to minimize human and environmental risks.

Recommendation No. 12: CAD SUP program must include support for three essential components: (a) a comprehensive training program on "best practices" in SUP (see 3.11); (b) locally, climatically and technologically appropriate[30] protective clothing and equipment (gloves, masks, boots, etc.); and (c) maintenance and repair of spray equipment.

4.3.13 Possible Toxicological Hazards to Humans or to the Environment: 22 CFR 216.3 (b)(1)(i)(e)

A pesticide risk analysis was done on the close to 5 products that passed the first screening test (see Table No 29.). This analysis included a look at acute and chronic toxicity of the selected pesticides to humans, its eco-toxicity and potential for water contamination. As a result, recommendations were drawn as to the general and specific mitigation activities to be conducted in order to prevent and/or reduce the potential health and/or environmental impact of the various pesticides of the program. These mitigation activities are all encompassed within the comprehensive risk mitigation-SUP and IPM programs.

Recommendation No. 13: CAD should socialize and share with project operators the results of the risk analysis of the pesticides and assure the full implementation of the mitigation measures recommended.

4.3.14 The Effectiveness of the Pesticides: 22 CFR 216.3 (b)(1)(i)(f)

Recommendations for pesticide and other pest management tactics to be used in the various crops have been gathered and or double-checked with authoritative agricultural R&D institutions of Colombia. Additionally, literary references and relevant web sites were consulted. It is to point out that, in Colombia, CAD has an abundance of institutions that can provide technical information and support, as well as training in pest and pesticide management.

4.3.15 Compatibility of Pesticides with Target and non-Target Organisms: 22 CFR 216.3 (b)(1)(i)(g)

[30] This means adequate for the local climate (temperature and humidity) and possibly adapted from local materials (plastic bottle masks, plastic bags-gloves, etc.) instead of imported clothing materials.

The pesticide risk analysis mentioned above, and described in this section, discuses the main risks the pesticides pose to non-target organisms in the environment, as well as some potential impact on target organisms, such as the likelihood of encouraging the development of pest resistance. Also mentioned in the table are some of the main direct mitigation measures to prevent and reduce the potential impact of the various pesticides to non-target organisms. The more general approaches to prevent and mitigate the health and environmental impacts of pest management activities, discussed elsewhere in this PERSUAP, are SUP and IPM.

4.3.16 Conditions under which the Pesticide will be Used: 22 CFR 216.3 (b)(1)(i)(h)

The majority of the Colombian territory is formed by plains located below 500 meters over sea level (mosl). The country could be roughly divided into six great geographical regions. The Andean one, including three Andean mountain ranges and the "inter-Andean" valleys; two coastal regions, the Caribbean and the Pacific ones; the plains of Antoquia region; the Amazonian forests; and finally, an insular region.

The CAD project is being implemented in Southern Colombia, in the Departments of Putumayo, Huila, Cauca, Nariño, Caquetá, and in the North East Department of Norte de Santander. The commonality of all these territories is that they are all used for illicit crops, coca and poppy, cultivation.

Colombia's climate is tropical with patterns strongly influenced by the Andes. They are normally classified as: (a) hot for ca. 84% of the territory, reaching up to 1,000 mosl and with an average temperature of 24 º C; (b) temperate, at altitudes between 1,000 and 2,000 mosl, with an average temperature of 17.5 º C; and (c) cold, with average temperature of 12 º C, and at altitudes of 2,000-3,000 mosl.

Ecologically, Putumayo, Caquetá, Norte de Santander, and Huila have a predominant pre-mountainous humid forest (Bh-pm) with close to 1,000-2,000 mm/yr, 18-24˚C, to low mountainous forest (Bh-mb) 2,000-2,500 mosl 12-18˚C. So these departments are in the hot climate area. Cauca, Nariño and Tolima have predominance of pre-mountainous to mountainous forests with a much more variable level of humidity and their climate is temperate to cold.

4.3.17 Availability and effectiveness of other pesticides and of non-chemical Controls: 22 CFR 216.3 (b)(1)(i)(i)

The use of pesticides in CAD projects will be inserted into comprehensive IPM programs. The "Decision Making Tree for IPM & a Guideline for SUP", discussed above, should help in making decisions if and when to resort to pesticides. But the matrices shown in this section present other available pesticide options and other pest management tactics for the crop and pest in question. There are, however, some problems with certain recalcitrant pests, such as ants, that are ubiquitous and pose a serious threat to certain crops, such as young trees, rubber, oil palm and heart of palm. Ants are not easy to control, and tend to

draw to some of the most toxic chemicals, such as carbofuran and chlorpyrifos. Non chemical options are being suggested and proposed in the pest and pest management matrices for some of the crops.

An example of a non-chemical approach to a recalcitrant pest: the case of ants

- Attractive baits
- Nest destruction early on their development
- Prevention of the emergence of winged ants with covers
- Applying cal to change pH and destroy the fungi that is used as a food by ants
- Seeding castor bean (*Ricinus communis*) in rotation or inter-cropped (inhibits ants)
- Plough-in green manure (organic matter attracts them away from crop)
- Irrigation

4.3.18 Capability of Colombia to Regulate and Control Pesticide Use: 22 CFR 216.3 (b)(1)(i)(j)

As stated above, Colombia is one of the most advanced countries in Latin America with respect to pesticide registration, regulation, and control. Colombia has very modern registration procedures, applies international standards and codes for pesticide labeling and has a system to follow up and control pesticide manufacturers and distributors that is only limited by the insecurity situation that the country has been living in for the past 25 years. The Instituto Colombiano Agropecuario, ICA, in charge of pesticide regulation, has taken more than 30 actions to ban hazardous pesticides or groups of pesticides, among hich DDT, methyl bromide, canfechlor, captafol, all organochlorides, and toxaphene. Moreover, ICA requires that all Class IA and IB pesticides sold in the country have a back up 'prescription' written by a professional agronomist. Undoubtedly, the widespread insecurity in the majority of the rural territory of the country, and more specifically in the areas where CAD is active, limits the enforcing capacity of the GOC institutions. Although, the degree and effectiveness of controls in these areas is somehow limited and less than desirable, during the preparation of this PERSUAP we had first hand evidence of on going inspections to pesticide dealers in the Department of Putumayo, one of the most affected by the conflict.

Colombia pesticide regulation fits within its larger environmental framework, as per law 99 of 1993, "Fundamentals of the Colombian Environmental Policy". This law created the Ministry of Environment and the National Environmental System and established the "Environmental Licences" which were further regulated by decrees 1728 of 2002 and 1180 of 2003.

The modernization of Colombia legislation related to pesticides begins with a major law, No. 09, approved by the National Congress in January 1979, regulating "hazardous substances, pesticides, and pyrotechnic articles". This is followed by decree No. 1843,

from 1991, that further "regulates the use and management of pesticides". This decree defined and clarified terms and elements for the registration of pesticides, such as "efficacy", "contamination", "fumigation", "residue limits", "risk" and "toxicity", and officially adopted the four-classes WHO hazard classification of pesticides[31]. The same decree further regulated the manufacture and distribution of pesticides in the country.

More recently, Colombia has fully adopted the regional norms that derive from the actions taken by the 'Andean Community"(Comunidad Andina, CAN), to which Colombia is a signatory. The CAN, a result of the integration of Bolivia, Colombia, Ecuador, Peru and Venezuela, began activities in 1997 and in 1998, it passed the 'Andean Norm for the Registration and Control of Chemical Pesticides for Agricultural Use" (Decision 436). In it, the five Andean countries committed themselves to a normative towards a common system for registration, control and use of pesticides. CAN decision No. 436 established, among other things, (a) the requirements for pesticide registration; (b) norms for labeling and packaging; (c) maximum residue tolerances; and (d) norms for product efficacy research. Later, by resolution 532, of August 2001, CAN adopted the 'Technical Manual for the Registration and Control of Chemical Pesticides for Agricultural Use", which was fully developed and published in June 2002, in Resolution 630. This very comprehensive manual, includes detailed instructions to register chemical pesticides, with all the information requirements on the technical as well as the formulated material, as they relate to efficacy, human and eco-toxicology, residues, labeling, packaging, risks and the environmental management plan. Finally, ICA, as the GOC institution mandated with the registration and control of pesticides, fully norms the application of the CAN decrees internally to Colombia, in its resolution No. 00770 of March 2003.

Given this comprehensive and detailed pesticide regulation framework, again, the capacity of Colombia to regulate and control pesticides is only restricted by the general situation of the country, with somewhat weak institutional presence in certain isolated areas. This scenario, however, does not preclude, as we reported above, that ICA authorities are still enforcing some of the pesticide ules and regulations.

4.3.19 Provisions for Training in SUP and IPM: 22 CFR 216.3 (b)(1)(i)(k)

The CAD supported SUP training program should focus on risk reduction rather than on safe use of pesticides. In other words, instead of sending the message that pesticides could be used safely, the main goal of the training program should be to reduce the risk of farmers and their families by the careful analysis, and management, of the variables that affect the components of risk:

Risk = toxicity x exposure

[31] The WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), and 'U' (improbable of presenting an acute risk in normal use). The LD_{50} used for chronic toxicity is either oral (O) o dermal (D). Colombia uses the same classification but classes are numbered I-IV.

This means that the "safer use", through risk reduction, begins before the "use" of the product, during its selection and preparation, and continues well after its use, in the field where the product is applied[32].

The SUP training could be sub-contracted from Bayer CropScience or from Servicio Nacional de Aprendizaje-Asociación Nacional de Industriales (SENA-ANDI). The former, a chemical company, runs a program called "Agrovida" that focuses on SUP for farmers or farmers families. Since women and children are in the higher vulnerability group, and women are often involved in the storage of pesticides as well as in cleaning farmer's clothes, they are an audience of extreme importance to be reached with messages of risk reduction. The second is a joint program between a GOC agency, SENA, and the association of industry and it offers two options, a two-day user targeted training course and a 5-day training-of-trainers event. CAD should consider training a few 'trainers', from the operators' staff, in each one of the regions where it operates.

The contents of the training program may need to be adjusted as per the various audiences but should include the themes listed in the training program attached, such as risk management, toxicology, labels, transporting, storage, mixing, spraying, cleaning, discarding, container management, applicators protection, etc.

Recommendation No. 14: Training on SUP should (a) focus on risk reduction; (b) reach the various important audiences: pesticide dealers, farmers, farmer families (women and children), staff of CAD project operators (trainers); (c) use the already available training offers in Colombia, such as the 'Agrovida' program, by Bayer CropScience, for farmers and their families (women and children), and/or that of SENA-ANDI joint training program for farmers and trainers.

As stated previously, in order not to transmit the false idea that pesticides, used safely, could be the sole solution to pest problems, SUP should not be promoted in isolation but rather in the context of a larger, more comprehensive approach to pest management, that of Integrated Pest Management, or IPM. Moreover, training in ecological and organic agricultural concepts and practices may always help CAD project operators to better understand, and even search for and experiment with, non-chemical options for pest control

Recommendation No. 15: CAD should promote a holistic agro-ecological approach, not only to pest management but also to crop production. Training, as well as technical support, offers in topics such as IPM, organic or ecological agriculture, are available in Colombia from various institutions. A list of the possible technical partners that CAD could resort to in the search for technical support follows.

[32] For more details see in section 5.3 the Power Point presentation "A Practical Guide: Reducing Pesticide Risk", in Spanish.

Table 24. Possible Technical Agreements for CAD

Institution	Crop	Theme
CIAT	Cassava, dry-beans, vanilla	Pest & crop management
Fedecacao	Cacao	Pest & crop management
Cenicaña	Sugar-cane	Pest & crop management
Cenipalma	Palm oil, heart of palm	Pest & crop management
Centro de Excelencia en Fitoprotección (CEF)	Tree tomato, lulo, maracuya, tomatoes, Amazonian fruits	Quarantine, pest management, pest risk analyses
Corpoica	Various	IPM in general; training
CONIF	Forest plantations, nurseries	Pest & crop management
IICA	Various	Ecological agriculture
IPGRI	Various	Quarantine & plant introductions
ICA	Various	Pesticides: registration & control; training
SENA	Various	IPM & organic agriculture; SUP; training
ANDI	Various	SUP training
Bayer CropScience	Various	SUP training: Agrovida
SGS / BioTrópico	Various	Certifications

4.3.20 Monitoring Effectiveness and Use of the Pesticides: 22 CFR 216.3 (b)(1)(i)(l)

CAD is working with farmers associations and enterprises that have a relatively good level of organization. Most have very well trained field technicians that are regularly monitoring the pest management problems and the effectiveness of pest management methods being used. Open and regular reporting lines exist within CAD project operators and Chemonics to communicate issues such as new pests appearances as well as failures of the standard methods being used. Moreover, the Natural Resources and Environment group of Chemonics has the capacity for, and it is taking a lead role in, monitoring the most significant environment related variables of the project, including the effectiveness of pesticides.

4.4 ENVIRONMENTAL COMPLIANCE

4.4.1 Monitoring

A set of indicators for compliance with the recommendations of this PERSUAP, grouped by major themes is being proposed and presented in the table below.

Table 25. Monitoring Plan for PERSUAP Recommendations

Monitoring Theme	Recommendation	Indicator/s	Special Requirements
Sustainable alternative development	1	♦ Poly-cropping promoted & adopted by farmers ♦ System approach to alternative development in place, promoted & being implemented	Re-asses promotion of crops versus systems
Phytosanitary system for movement of plant materials	2	♦ ICA certification in place for internal movement of plant materials ♦ Quarantine in place for foreign materials	Establish links with ICA
Safer Use of Pesticides: hazard awareness, pesticide phase out, pesticide screening, training program, equipment support, risk analysis	3, 4, 5, 8, 9, 10, 12, 13	♦ Operators aware of color band meaning in products & using info for selecting pesticides ♦ Operators pesticide request list regularly checked by CAD-NRE[33] team ♦ Trend for decreased 'red & yellow' band pesticides request lists ♦ No monocrotofos & paraquat by Dec '03 ♦ No methomyl & others by Aug 04 ♦ No chlorpyrifos, carbofuran & others by Aug 05 ♦ SUP KAP changed ♦ Parts & repairs offered for spray equipment	Training programs contracted & courses offered. Financial resources from CAD allocated for training & equipment
Integrated Pest Management: training (IPM, Eco), bio-pesticides, field demos	6, 7, 11, 14	♦ Ecological agriculture & IPM training contracted, offered, finished & KAP[34] monitored ♦ IPM demo fields installed & monitored for all crops ♦ Operators aware of & using bio-pesticides ♦ Operators using a wide range of pest management practices (more than 3 per pest)	Training programs contracted & courses offered. Financial resources allocated for IPM demos
Sustainability of Environmental Compliance	16	♦ Market-led environmental compliance through: organic agriculture, EurepGap, Illicit-to-Licit or other type of certification in place, or ♦ A third party system installed for auditing environmental compliance	Contacts made, bids open, resources allocated to initiate / catalyse both processes

4.4.2 Long Term Sustainability

Environmental compliance with Regulation 216, vis-à-vis pesticide issues could be assured through the auditing role of Chemonics NRE group. This group could possibly check the pesticide lists that CAD project operators regularly submit to Chemonics for approval and screen the pesticides appropriately. It may also field check project operators to inspect pesticide storage buildings, follow up some field operations and check on pesticide selection, mixing and use. [This has already been proposed in Recommendation No. 8]. However, since this monitoring is based mainly on a 'policing' approach to compliance, its sustainability is somewhat questionable. Although, an important 'educational' component,

[33] Natural Resources and the Environment
[34] KAP: Knowledge, Attitude and Practices.

on SU and IPM, has been included in this PERSUAP, farmers may 'comply' with environmental regulations only and as long as the policing pressure is maintained. And this will only happen as long as USAID and Chemonics continue with the funding and implementation of CAD. But it may end right after that …

A fundamentally similar approach, but one that promotes a more direct participation, and so appropriation of environmental compliance issues, by the Colombian civic society, is that of allocating the 'policing' role to a 'third party' local NGO, or consultant. The profile of this auditor may be similar to the NGOs or consultants that Chemonics NRE group has already contracted to do the environmental studies of CAD productive activities. The local, Colombian, NGOs and consultant companies visited have demonstrated the capacity and the interest to undertake such work. Based on the table above, and on the 16 recommendations of this PERSUAP, CAD could develop a more detailed monitoring plan, agreed to among USAID, Chemonics, and the CAD operators, and assign a third party agency its verification following a system of open bids, as it is normally done in CAD.

A more sustainable path to environmental compliance may be that of a 'market-led' mechanism. If the market rewards an environmentally sound, clean, ecological or whatever the label is, produce then farmers will have to comply with certain production norms in order to be able to access and receive that reward. Third party certification is the key to this and not necessarily has to take the form of purely 'organic' production. Some of the Colombian certifying agencies contacted, such as *Biotrópico,* are working on organic produce certification, with the support of IFOAM, but also certify other producers. Among the latter are the coffee growers associated in COSURCA, exporting 'fair trade' coffee to the US market, in a project funded by USAID and UNDP. Other enterprises, such as the Swiss SGS, are certifying aromatic plant producers for EurepGap norms as well as Colombian flower exporters. Finally, the fruit growers association ASPROME, based in Cali, is exporting 'organic marmalades' to Europe, certified by Naturland-IFOAM, from fruits produced in a project funded by GTZ, the German Government and the European Community. The certification system is so simple as to work out a detail set of agreed rules, and corresponding indicators to track them, between producers, donors, project implementers and the certifying agency. The rules could easily be those established as environmental compliance requirements in Regulation 216, tracked by indicators such as pesticides registered with Colombia-ICA and US-EPA, no RUP pesticides, no class IA and IB products, etc. Again, the table in 4.1 and the 16 recommendations could be used as the basis for a framework for certification of USAID environmental compliance.

<u>Recommendation No. 16</u>: CAD is encouraged to seek a sustainable mechanism for pesticide environmental compliance. This could take the form of (a) a third party independent auditor of the use and management of pests and pesticides by project operators; and/or (b) a market lead environmental (vis-à-vis pesticides) compliance mechanism through a third party, independent, certification agency that assures 'organic', 'EurepGap', 'low-intensity pesticide usage', 'IPM-based', or Regulation 216-based … agricultural production.

4.4.3 Training and Best Agricultural Practices Plan (BPA). Pursuant to Recommendations in the Pesticide Evaluation Report and Safe Use Action Plan PERSUAP[35]

Insect pests[36] are one of the principal problems affecting agricultural production and crops, decreasing productivity and/or product quality, resulting in important economic losses. Moreover, improper management and abuse of pesticides utilized in plague control may also lead to severe economic losses and negative environmental impacts (air pollution, contamination of soil and water resources) as well as loss of biodiversity and other negative effects. The combination of the negative factors mentioned above also cause the worst of all affectations i.e., the health of agricultural workers, their families and even, the health of consumers of agricultural products, is threatened.

CAD complies fully with USAID's provisions, the grantee agency, established in USAID's regulation 216. CAD has already carried out detailed environmental assessments of productive agricultural and transformation activities that are being or will be supported by the project. Such studies are known as Environmental Assessments (EA) and include, normally, an environmental diagnosis of the project site, a study of potential impacts caused by project activities and an environmental management plan that proposes prevention and mitigation measures of possible environmental impacts caused by development activities.

Specifically, CAD just completed phase 1 of a detailed study no pesticides currently used in more than 20 productive projects, including alternative methods to replace the use of pesticides available in Colombia for agricultural plague management. CAD is presently implementing phase 2 of this study covering almost 40 additional crops. This study, called "Pesticide Evaluation Report and Safer Use Action Plan", or PERSUAP, follows closely the requirements stated in Regulation 216 of the United States Government applicable to each type of pesticide that may or will be used in CAD projects, planned or recommended, for crop plague management, as called for in 12 sections of Regulation 216, including:

[35] Draft No. 3, 29 October 2003

[36] The term Plague utilized through this document refers to its broad generic meaning, including insects, other arthropods and invertebrates, several pathogens, weeds and vertebrates.

1. Status of registration of pesticides in Colombia and with USEPA;
2. Basis for selection of pesticides for any particular application; why was such pesticide selected?
3. To which extent is pesticides part of Integral Plague Management systems?
4. Methods of application, including availability and use of appropriate equipment for application of pesticides and protective measures;
5. Acute long-range risks to humans and the environment, associated to proposed use of pesticides and available measures to reduce dangers thereof;
6. Efficacy of selected pesticides to meet expected results;
7. Compatibility of pesticides with natural ecosystems within their main objectives or other project objectives proposed;
8. Conditions under which pesticides will be used, including weather, flora, wildlife, geography, hydrology and soils;
9. Availability and effectiveness of other pesticides and/or non-chemical methods to control target plague(s);
10. Capability of operators and project implementers throughout Colombia to regulate or controlling distribution, storage, use and final disposal of pesticides;
11. Provisions for training of pesticide users and operators;
12. Provisions for effective monitoring, use and efficacy of pesticides.

The study mentioned above includes a list of (a) **banned pesticides**, prohibited in Colombia and in The United States (the donor country) or in both countries; (b) **products not approved,** or restricted in The United States, or products potentially harmful to human health or the environment in Colombia. A process of substitution of these products within a 0.5 – 1 year timeframe has been established; and (c) **approved products** that may be utilized in CAD projects. Beyond the strict control measures exerted by CAD on the use of pesticides in CAD projects, there is a commitment to promote the Best Agricultural Practice (BPA) production activities, including Integrated Plague Management (MIP) and Safe Use of Chemical Pesticides (USP), to contribute to sustainable alternative development. With this in mind, CAD developed a far-reaching training plan in support of BPA, MIP and USP.

4.4.4 Training Plan

The Training Plan follows-up the application of PERSUAP recommendations. Its general objective is **to develop technical capacity within CAD project operators, at the technical and production levels, to implement clean environmental production systems contributing to minimize hazardous risks on producers and consumers health.** This plan was developed to assure that CAD not only complies with PERSUAP recommendations, but also will meet program indicators and goals listed in the Monitoring Plan, in regards to use of pesticides and agricultural plague management activities carried out by project operators.

Specifically, the Training Plan aims to develop particular and broad technical skills in (a) **safer use of pesticides in agriculture**, such as appropriate approaches: ecological, economical and social; (b) **integrated management of agricultural pests**, applying appropriate technological, economic and social systems approach; (c) **ecological or**

organic agricultural production, if such approach is economically feasible within a production methodology context applicable to protection of the environment and human health. The proposal aims towards offering general training and specific training to technicians to strengthen their capability, thus enabling technicians to offer productive options to participant farmers, including social, economical and environmentally acceptable elements.

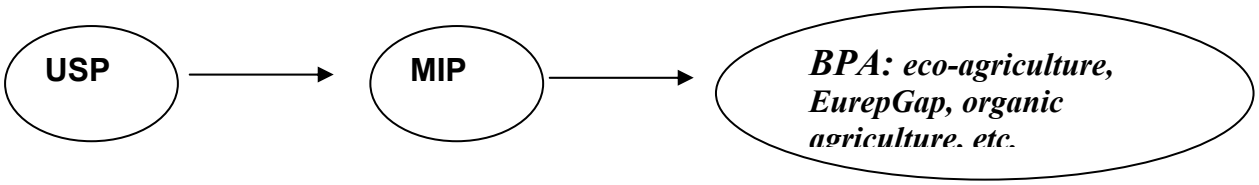


Table 26
Pests in Cacao Farming (*Theobroma cacao)* and Management Guide

General Comments: Cacao farming offers an excellent opportunity for implementation of viable management systems to control pests affecting crops and minimize the use of external agents; in particular, avoiding the use of chemical pesticides, as well as the promotion of environmental "clean" practices in farm crop management. This "ecological" proposal approach adapts well to normal farming practices and to Fedecacao, the National Cacao Growers Associations, policies.

Pest(s)	Control Methods	Pesticides[i]	Problems
Diseases:			
Moniliophthora roeri (Moniliasis)	Cultural: decrease internal humidity; apply shade and weed control , pruning and fertilizing.	Fungicides do not function well.	Attacks fruit. Systemic fungicides are expensive.
	Physical: sanitary pruning of sick cobs at 8 days intervals at the beginning of rain/flowering season/ cycles, repeat after 15 days.		
Crinipellis perniciosa (Witches broom)	Cultural: pruning and shading regulation, weed control.		Attacks trunk and branches. Causes less damage than *Monilia.*
	Physical: pull brooms out (17-week cycle)		
Phytophthora sp. (brown cob rot and trunk cancer)	Cultural: decrease internal humidity; exert shade and weed control, pruning and fertilizing.	Metalaxyl may be required along with a healing paste spread over affected trunk areas and machete inflicted cuts or other wounds.	Attacks trunk and fruit. Associated to humid conditions. Infection is caused by zoospores reaching plantations through water, rain, ants and animals.
	Physical: same as *Monilia.* It is difficult to differentiate symptoms in Monilia and *Phytophthora* attacks.		
Rosellinia pepo (Roselinia or star wound)	Cultural: adequate shade management and fertilizing.		Attacks woody roots. Saprophytes pass to parasite state if so allowed. *Inga* trees, a species used as shade, are prone to fungi infestation.
	Physical: destruction of sick trees in large areas, if necessary. Burn roots, allow for sunlight to reach soil.		
	Chemical:	Use herbicides to dispose of sick trees applying only with chemicals such as Roundup, or better yet, inject picloram.	PUR. See recommendation . Attention: there is one method of applying picloram that is not restricted. Use this application.

[i] Pesticides in this Table are not necessarily recommended for CAD projects. Check pesticide Tables

Plague(s)	Control Methods	Pesticides	Problems
Ceratocystis fimbriata (machete disease)	Cultural: sanitary branch pruning.	It is important to disinfect tools used in farm practices.	Product has low-incidence and little impact on pests. *Cyleborus,* an insect associated with biological control of pests, transmits machete disease. Disease may be transmitted by improper use of farm tools.
	Physical: burning trees may be used in extreme situations.		
Arthropods:			
Monalonium dissimulatum (yellow chinche) and *M. annulipes* (red chinche)	Cultural: decrease shading and pruning		Focalized attacks.
	Mechanical: kill larvae by squeezing cobs manually.		
	Physical: Pass burning torches through infected trees.		
	Chemical:	Use Malathion in exceptional situations (less than 5 percent).	
Red army ants (*Atta* spp.)	Physical: Disturb ant's nests mechanically. Avoid flying ants from emerging.		Attacks seedlings, innocuous to adult trees.
	Chemical:	Use lime to change soil pH to destroy fungi used by ants as a food source. Use Malathion or clorpirifós (localized) in exceptional, extreme situations only.	Clorpirifós is PUR. See recommendations.

Technical assistance sources, training and contacts:

1. **Sr. Jacob Rojas Ardila**, **Gerente Técnico, FEDECACAO**. Mr. Rojas knows cacao phytosanitary problems well, he is available to provide technical assistance and organize training workshops, if necessary
2. **Dr. Jairo Osorio, Coordinador de MIP, Corpoica.** Corpoica is conducting research in use of antagonistic and resistant genetics.

Table 27. Basis for the selection of Cacao Pesticides

[Addresses Reg. 216 point (b)]

Pesticide		Uses		Basis for Selection
Technical Name or Active Ingredient	**Trade or Commercial Name in Colombia**	**Crop**	**Pest**	
Gliphosate	Roundup	Cacao Oil palm, Heart of palm, Rubber, Plantain, Forestry plantations	Cacao plants affected by *Rose-llinia pepo* Weeds in general	Effectiveness. Reduced health & environmental impacts. Cost. Availability.
Malathion	Inition, Cropthion, Fyfanon, Malathion, Algodonero	Cacao Plantain Cassava	Ants (*Atta* sp.), 'stings bugs'. Defoliants. Stem borers (*Coelosternus,Lagochirus*, *Chilomima*)	Cost. Availability. Effectiveness.
Metalaxyl	Ridomil (only in mixes with mancozeb)	Cacao Cassava Rubber	*Phytophthora Phythophtora y Xanthomonas Phytophthora palmivora*	Cost. Availability. Effectiveness. Unique product for Phytophthora control.
Picloram	Tordon, Closser, Grazón	Cacao Pastures	Diseased cacao plants c/*Rose-llinia pepo* Bushy weeds	Cost. Availability. Effectiveness.

Table 28. Cacao Pesticides. [i]Registration, Problem Analysis & Preliminary Decision [reg. 216 point (a)] pesticide

Pesticide			Crop/s	Pests/ s	Type of Problem, if any	Recommenda-tions & alternative/s
Technical Name[ii]	**Trade Name[iii]**	**Type & Tox Class[iv]**				
Gliphosate (glifosato)	Roundup	Herbicide. WHO TC U; Colombia TC III ó IV	Cacao Oil palm, Heart of palm, Rubber, Plantain, Forestry plantations	Cacao plants affected by *Roselinia pepo* Weeds in general		**Approved.**
Malathion	Inition, Cropthion, Fyfanon, Malathion, Algodonero	Insecticide. WHO TC III; Colombia TC II-III	Cacao Plantain Cassava	Ants (*Atta* sp.), 'stings bugs'. Defoliants. Stem borers (*Coelosternus,Lagochirus*, *Chilomima*)	In IRED-03 list. In 'Bad Actor' list of PAN for cholinesteras e inhibitor. Organophosphate.	**Approved.** But pending of re-registration with USEPA in 2003.
Metalaxyl (Metalaxil)	Ridomil (only in mixes with mancozeb)	Fungicide. WHO TC III; Colombia TC III	Cacao, Potato Cassava Rubber	*Phytophthora Phythophtora y Xanthomonas* *Phytophthora palmivora*	It was in re-registration with US-EPA.	**Approved.** Re-registration approved by USEPA in Sep 1994.

[i] Includes the pesticides being mentioned for the cacao crop, requested by CAD Project operators and/or recommended as part of pest management program.
[ii] Generic name or active ingredient.
[iii] Name Ander which is sol in Colombia.
[iv] Type of action: fungicide, insecticide, herbicide, etc. As per WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), and U (improbable of presenting an acute risk in normal use). The LD_{50} used for chronic toxicity is either oral (O) o dermal (D). WHO is that of the active ingredient. Colombia TC is that of the formulated product available in the country.

Pesticide			Crop/s	Pest / s	Type of problem, if any	Recommenda-tions & alternative/s
Technical Name	**Trade Name**	**Type & Tox Class**				
Paraquat	Gramoxone, Agroquat, Calli-quat, Paraquat	Herbicide. WHO TC II; Colombia TC I	Cacao, Plantain, Heart of palm	Weeds, eradication of badly diseased cacao plants	RUP with US-EPA.	**Should not be used. Phase out IMMEDIATELY** . Alternatives: gliphosate; picloram 101R
Picloram	Tordon, Closser, Grazón	Herbicide. WHO TC U; Colombia TC II, III, ó IV	Cacao Pastures	Diseased cacao plants c/*Rose-llinia pepo* Bushy weeds	RUP with US-EPA – except Tordon 101R	**Not to be used, in general.** If no substitute available, use only Tordon 101R.

Table 29. Cacao Pesticides – Risk Analysis

Pesticide[i]	Acute Tox Class[ii]	Type	Chronic Toxicity	Eco-toxicity	Groundwater Contamination Potential	Mitigation of risks / Comments[iii]
Gliphosate	WHO U; Colom-bia: III- IV	Herbicide	No evidence of any carcinogenic, teratogenic, mutagenic effects.	Slightly toxic to birds, non toxic to fish & bees.	Unlikely due to soil adsorption.	
Malathion	WHO III; Colom-bia: II-III	Insecticide	Organophosphate = cholinesterase inhibitor. Possible carcinogenic & suspected endocrine disrupter	Highly toxic to honey bees, moderately toxic to birds & variable toxicity to fish	Possible contaminant. It has been detected in well & ground waters.	In IRED-03. Revise registration status in 2003. Malathion should be used with great care in order not to expose workers & prevent water contamination & effects on bees & birds
Metalaxyl	WHO: III; Colom-bia: II	Fungicide	Carcinogeneicity still unknown. No other effects on humans.	Practically not toxic to birds, bees & fish	Potential water contaminant	Re-registration approved by USEPA in Sep. 94
Picloram	WHO: U; Colom-bia: IV (G)	Herbicide	Non teratogenic, weakly to no mutagenic, weakly carcinogenic.	Slightly toxic to birds & fish & not toxic to bees. Hazard for no-target plants, crops & others	Potential for ground water contamination.	RUP with USEPA except Tordon 101R formulation. Use only this one.

[i] Technical name or active ingredient

[ii] As per WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous) and U (unlikely to present acute hazard in normal use). The LD_{50} used for acute toxicity is either oral (O) or dermal (D). Colombia uses the same scale but classes numbered I-IV.

[iii] General mitigation tactics to (a) reduce human exposure risks; protective clothing (mask, hat, glasses, long sleeves short, long pants, boots, gloves or plastic bags, washing clothing, no food, no drink, no smoking, no re-entry to fields, etc.) and (b) reduce environmental risks (mix exact amounts, no spray close to water bodies, to bee hives, to bird nesting areas, avoid windy days, etc.) are part of a more general SUP.

Table 30. Banned pesticides Pesticides, PIC, Prohibited, Restricted or Cancelled In Colombia and/or in the USA[45]

Pesticide[46]	PIC List[47]	Registration status in[48]	
		Colombia	United States
Aldrin	Yes	P (1974 in tobacco), C (1988)	No
BHC		P (1974 in tobacco), P (1978 in coffee), P (1993)	No
Methyl Bromide		P except for quarantine (1996)	RUP
Canphechlor		P (1978 in coffee), C (1988), P (2000)	No
Captafol	Yes	P & C (1989)	No
Chlorinated in tobacco		P (1974)	No
Chlordane		P (1974 in tobacco), C (1988), P (1993)	No
Chlordimeform		P (1987), C (1988)	No
DBCP (di-bromo-chloro-propane)		P (1982)	No
DDT		P (1974 in tobacco), P (1978 en café), P except in health (1986), P (1993)	No
Dicofol		P (1993)	Yes
Dieldrin		P (1974 in tobacco), C (1988), P (1993)	C
Dinoseb		P (1987)	C
Dodecachlor (Mirex)		P (1993)	C
2,4,5-T & 2,4,5-TP		C (1979)	C
Endosulfan		P except for coffee borer (1993 & 1997)	RUP
Endrin		P (1974 in tobaco), P (1985)	No
Ethylene di-bromine (EDB)		P (1985)	No
Fonofos		P (1992)	No
Fosfamin		C (1997)	RUP
Mercury Fungicides		C (1974)	No
Heptachloro		P (1974 in tobacco), C (1988) P (1993)	No
Isazofos		C (1996)	No

[45] It is not an inclusive list for the US or PIC. It is based on Colombian prohibited products.

46 Technical name.

47 The list of products for **'Previous International Consent'**, or '**PIC'** (1998), of the United Nations Environment Program (UNEP) and the Food and Agriculture Organisation (FAO). FAO leads in relation to pesticides. Alow importing countries to better know the potentially hazardous products that may be sent.

48 '**P' = 'Prohibited'** = '**Banned**" = the uses of the product are not permitted in the country, by explicit decision of the regulat

ory agency. '**R' = 'Restringido'** = **'Restricted'** = in the sense of the USEPA, it is a pesticide that can only be applied by a certified applicator. '**C' = 'Cancelado'** = '**Cancelled**' = registration cancelled without a specific prohibition. **No**: not registered.

Pesticide	CIP List	Registration Status in	
		Colombia	United States
Leptofos (Phosvel)		C 1977	No
Lindane		P (1978 in coffee), C (1993), P except in health (1993), P (1997)	RUP
Maneb		C (1989), P (1993)	Yes
Metamidophos	Yes	Yes	Yes
Monocrotophos	Yes	Yes	Yes
Organochlorines in general		P (1974 in tobacco), P (1978 in coffee)	No
Paraquat		P aerial application (1989)	RUP
Parathion & methyl-parathion	Yes	R only for cotton & rice (1991)	RUP
Pentachlorophenol (PCP)		P (1993)	GUP & RUP (treatment of wood)
Posphamidon	Yes	No	No
Toxaphene		P (1975 in tobacco), P (2000)	No
Zineb		P (1993)	No

[1] It is not an inclusive list for the US or PIC. It is based on Colombian prohibited products.
[1] Technical name.
[1] The list of products for '**Previous International Consent**', or '**PIC**' (1998), of the United Nations Environment Program (UNEP) and the Food and Agriculture Organisation (FAO). FAO leads in relation to pesticides. Alow importing countries to better know the potentially hazardous products that may be sent.
[1] '**P'** = '**Prohibited**' = '**Banned**" = the uses of the product are not permitted in the country, by explicit decision of the regulatory agency. '**R**' = '**Restringido**' = '**Restricted**' = in the sense of the USEPA, it is a pesticide that can only be applied by a certified applicator. '**C**' = '**Cancelado**' = '**Cancelled**' = registration cancelled without a specific prohibition. **No:** not registered.

SECTION 5 ENVIRONMENTAL CONSEQUENCES

5.1 ENVIRONMENTAL GRADING (CA)

Methodology

The consultants established values in relation to quantitative and qualitative magnitude, and environmental quality parameters.

Parameters are inter-related using the Environmental Grading (Ca) equation .as follows

$$Ca = C [P (a E + bD)]$$

Existing dependency relationship between criteria were weighted according to importance through constants a and b, resulting in relative weighting equilibrium. Description of criteria and grading parameters of the Environmental Grading (Ca) is shown in table below.

Table 31. Description of Environmental Grading (Ca) criteria

Criteria	Description
Class (**C**)	**Class** defines the environmental change produced by project activities. May be positive (+) or negative (-), depending if the action improves or deteriorates the present or future environment.
Presence (**P**)	There is no absolute certainty of all effects that may be caused on the environment. Therefore, **Presence** grades probability of occurrence of the effects as a percentage of occurrence, in a scale of 0.0 and 1.0.
Evolution (**E**)	**Evolution:** the analysis and speed of the environmental effect, from beginning to end. Grading is done according to the relationship between the maximum magnitude by the effect and the time variable. It is expressed as units related to the speed of the effect. Its value range is from 0.00 and under 1.0, during 24 months to less than one month, respectively.
Magnitude (**M**)	**Magnitude:** is the quantification of the dimension or magnitude of the environmental change produced by a constructive, operative or abandonment action or process. Absolute magnitude values quantified or inferred are transformed in terms or relative magnitude (percentage value), this is a more realistic expression of the level of affectation of the environmental effect. Value ranges between 0.0 and 1.0, within minus 20% and over 80%, respectively.
Duration (**D**)	**Duration:** the evaluation of the period of active **duration** of the environmental effect and its consequences. Expressed as a function of time of duration of the effect. Values range between 0.0 and 1.0, corresponding to less than 1 year to more than 10 years, respectively.

Qualitative relationship may be calculated applying the equation above. Ranges of environmental alterations were determined for this purpose, taking into consideration the reported results in the environmental grading of each impact identified. See table below.

Table 32. Criteria, Ranges and Values for qualification of environmental Effects

Criteria	RANGE	VALUE
CLASS (C) (Sense)	Positive	(+)
	Negative	(-)
PRESENCE (P) (Probability of occurrence)	Certain	1,0
	Very probable	0.7
	Probable	0.3
	Low probability	0.1
	Not probable	0.0
EVOLUTION (E) (Speed of development)	Very rapid (< 1 month)	0.8 < 1.0
	Rapid (< 12 months)	0.6 < 0.8
	Medium < 18 months)	0,4 < 0.6
	Slow (< 24 months)	0.2 < 0.4
	Very slow (> 24 months)	0.0. < 0.2
MAGNITUDE (M) (Dimension or size)	Very high (> than 80%)	0.8 < 1.0
	Alta (between 60% and 80%)	0.6 < 0.8
	Medium (between 40% and 60%)	0.4 < 0.6
	Low (between 20% and 40%)	0.2 < 0.4
	Very low (< 20%)	0.0 < 0.2
DURATION (D) (period of active duration)	Very long (> 10 years)	1.0
	Long (> 7 years)	0.7 < 1.0
	Medium> 4 years)	0.4 < 0.7
	Short (> 1 year)	0.1 < 0.4
	Very short (< 1 year)	0.0 < 0.1
ENVIRONMENTAL IMPORTANCE (IA)	Very high (Ca between 8.1 and 10.0)	MA
	High (Ca between 6.1 and 8.0)	A
	Medium Ca between 4.1 and 6.0)	M
	Low (Ca between 2.1 and 4.0)	B
	Very low (Ca between 0.0 and 2.0)	MB
WEIGHTING CONSTANTS		a = 7.0 b = 3.0

Environmental Evaluation matrices were prepared within the context of Matrix 1 and tables above, identified as **M-2, M-3, M-4, M-5, M-6, M-7 y M-8,** including the qualification of **main resulting environmental effects** in each environmental project component (sub-activities or actions)

- **Environmental Grading (Ca) Support**

The following is an illustrative support of interactions or environmental effects A2, H2 and L2 of matrix M-1, referred to matrices M-2, M-3 and M-4, the biotic, hydric and edafolic components, respectively.

Table 33. Environmental Grading (Ca) Support, Vegetation (matrix M-1 and M-2)

ENVIRONMENTAL EFFECT	Loss of Plant Covering due to Soil Preparation		A2
PROJECT STAGE: Nursery		AFFECTED COMPONENT: Vegetation	
ASSESSMENT		DESCRIPTION	
Class (**C**)	N	Deterioration due to exogenous action	
Presence (**P**)	0.8	Very probable occurrence of affectation	
Evolution (**E**)	0.7	Fast loss occurrence	
Magnitude (**M**)	0.5	Medium nursery extension	
Duration (**D**)	0.2	Short, biological element	
Environmental Importance (B)	-2.44	Low environmental importance (B)	

Table 34. Environmental Grading (Ca) Support, Water quality (M-1 and M-3)

ENVIRONMENTAL EFFECT	Waste dumping on water bodies, natural or artificial processes		H2
PROJECT STAGE: Nursery		AFFECTED ELEMENT: Water	
ASSESSMENT		DESCRIPTION	
Class (**C**)	N	Physical Chemical alteration	
Presence (**P**)	0.4	Probable occurrence of alteration	
Evolution (**E**)	0.3	Slow, inert hydric body	
Magnitude (**M**)	0.5	Medium, nearby water bodies	
Duration (**D**)	0.6	Medium, persistent effect	
Environmental Grading (**Ca**)	-1.14	Very low environmental important (MB)	

Table 35. Environmental Grading (Ca) Support, Erosion Increment, (M-1 and M-4)

ENVIRONMENTAL EFFECT	Affectation of soil quality and properties due to loss of plant covering during preparation of land, favoring renewal of superficial layers by rain and wind action.		L2
PROJECT STAGE: Crop installation		AFFECTED ELEMENT: Soil	
ASSESSMENT		DESCRIPTION	
Class (**C**)	N	Loss of plant covering and soil	
Presence (**P**)	0.4	Probable occurrence of alteration	
Evolution (**E**)	0.3	Show, superficial layers of soil	
Magnitude (**M**)	0.2	Low, small isolated areas	
Duration (**D**)	0.3	Short, during seedling growth	
Environmental Grading (**Ca**)	-0.53	Very low environmental important (MB)	

An arithmetic average was used to determine the value of the environmental qualification for each project component and activity in order to apply the Environmental Grading (Ca) equation.

The environmental assessment for the main environmental interactions is shown in Matrices **M2 to M8,** in the following pages.

- **Summary of grading**

A summary matrix was generated with the Environmental Grading (Ca), including values calculated for Ca for each project component and activity. **Matrix M-9** shows the results of grading for the Cacao Project.

The hydric component is the most affected (-1.16), due to crop installation and management. Nevertheless, the environmental alteration is Very Low (MB), followed by geomorphologic aspects (-0.67) with environmental alteration Very Low (MB). Even then the Environmental Management Plan considers control and management of the above impacts in Guideline No. 5 Soil Component Management.

Other project components such as Socio-cultural, Socio-economic, Biotic, Climatic and Etiologic, present a positive environmental grading (3.17, 2.83, 0.66, 0.39 y 0.22, respectively). The PMA proposes measures in regards to positive functions of the project related to the social component. These are included in Guideline No. 8, the food security plan; Guideline No. 9 Support and accompaniment Plan; Guideline No. 10 Training, Guideline No. 11 Environmental Education Plan and Guideline No. 12 Industrial Safety Plan.

The arithmetic addition of CA values for each environmental component indicates that general affectation of the Norte de Santander (Tibú) project registers an environmental grade of 0.78, i.e. Very Low environmental importance (MB), while the Sur de Bolivar project registers 1.15, also Very Low environmental importance(MB).

Project activities incidence on agrologic soil characteristics in the plant reproduction areas for planting (nurseries, clone gardens, establishment of cacao as the sole crop, and agro-forestry arrangements);application of simple or composed formula fertilizers, pesticide and weed-killer amounts regulated by ICA and related control activities, are well under activity follow-up practices.

In regards to fertilization processes in nurseries, the clone gardens and crops, the related impacts may be negative and low, on account of possible contamination of watersheds by seepage and rain runoff that could transport waste and fertilizer residues.

Finally, in accordance with the Cacao project EA in Sur de Bolivar and Tibú, it is inferred that even though some activities are generating low affectations on the environment, said affectations could be decreased implementing the PMA. This would also decrease the CA, thus increasing beneficial effects to the community and the environment.

- **Conclusions**

In regards to impacts generated by Project activities, either cacao as the sole crop or in agro-forestry arrangements, affectations are not significant in importance or magnitude; therefore, impacts would not be expected to produce significant changes in the actual project status, as plantation sites of 3 ha or less are usually far apart from each other.

Moreover, it important to note that widespread deforestation affect functions and environmental services of importance to humans, animals and plants alike, in regards to the environment, native forests, wildlife habitats, watersheds, food production, organic applications to soil, ecosystem equilibrium and climatic changes.

- **Environmental feasibility of the cacao project**

The principal factors analyzed and assessed make cacao an environmental feasible project in Sur de Bolivar and Norte de Santander (Tibú). These factor are the following:

The ecological conditions of the cacao project indicate that soils in the project zone are apt for cacao crops. Affected soils by illicit crop activity may be recuperated by moderate fertilizing; planting trees will help to physical and chemical recuperation of the soils through incorporation of Nitrogen and other elements, as well as organic material and cacao tree biomass

Socio- economic and cultural aspects indicate that the cacao project will contribute with positive effects in the project zone.

Legal aspects indicate that the project will have no legal problems. The project does not require an environmental license , as it will not cause ecological damage. The project should be registered in the Registro de Plantaciones Forestales, in accordance with Decrees 1791 of 1996 and 1728 of 2002. Regulations on application of agrochemicals must adhere to legal requirements. An Integral Pest and Disease Management Plan must be duly implemented.

According to the Environmental Assessment, the cacao project environmental rating (Ca) average value in the 0.0 to 2.0 range over a maximum rate of 10.0, classified as Very Low.

5.2 IDENTIFICATION OF ENVIRONMENTAL EFFECTS (IMPACTS)

5.2.1 Introduction

The identification of environmental effects that may be caused by a Project is based upon examination and assessment of the project areas, activities, environmental resources involved and the community. The environmental conditions of the project zone of influence (Sur de Bolivar and Norte de Santander, Tibú) are weighed against project implementation activities, to determine the nature of impacts generated and finally, classifying the impacts to design control and management plans, under environmental quality parameters.

Environmental assessment is an analytical and interdisciplinary process that allows for objective judgment of consequences derived from impacts associated to project activities, through identification and grading of alterations according to environmental indicators. This EA phase includes assessing and comparing project environmental

performance with quality standards established in national environmental legislation, especially Law 99 of 1993, and USAID Environmental Regulations 216c.

- **Scope**

Specific activities in identification of environmental impacts include:

- Identification of processes and operations, products, waste, emissions, etc., including sources of emission and project control systems.

- Identification of aspects of special environmental interest affectations and characteristics.

- Identification of areas in which the Project operator must agree to concrete environmental commitments, and the scope and technical, economic and social consequences of said commitments.

- Preparation of matrices to identify and grade (qualification) and quantification (range values) of environmental impacts (effects).

- Summary or conclusions on environmental effects, established according to degree of affectation of the environment and environmental management recommendations.

- **Methodology**

Analysis of the information of and consultant's elements of judgment were considered in the process of identification and environmental assessment of the cacao project. The methodology used included:

- Identification and assessment of environmental impacts on the basis of the environmental diagnosis (Base Line) and technical description of the cacao project.

- Preparation and application of the Leopold Matrix, revised and adjusted to the cacao project activities and environmental components affected. The Leopold[49] Matrix was the first method used by the US: Geological Service, Secretary of the Interior, in 1971. This procedure was adjusted and complemented with assessment techniques under Chemonics supervision.

- Introduction of criteria and professional concepts in preparing and analyzing the Leopold Matrix,

[49] Instituto Tecnológico Geominero de España. Evaluación y Corrección de Impactos Ambientales, Madrid, 1991

1,484 possible impacts were identified during the assessment process by the consultants, based on information collected during visits to the project sites and the documentation provided by the project operator, USAID, Chemonics, PNDA, the ministry of the Environment, and the CARs in Norte de Santander and Sur de Bolivar (Corponor y CSB).

5.2.2 General Considerations

The usual methods of carrying out the identification and environmental assessment of a project is using qualitative parameter of grading. The identification of the cacao project constituted an essential procedure based on the principles of the Leopold Matrix. However, in Matrix M-1 attached, both the identification and the inicial qualification of the environmental impacts are considered, positive (1) or negative (0).

The environmental assessment was carried out for two project alternatives, in consideration of similarity of the ecological and environmental conditions in Sur de Bolivar y Norte de Santander (Tibú), as explained below.

Geographical Location both alternatives correspond to the equatorial zone, where ecosystems are dynamic, vulnerable and recoverable with opportune applications of environmental management measures.

Physiographic: both alternatives correspond to the mountain sub-regions: the hillsides of the San Lucas Sierra and the Motilones in Tibú.

Climate: both alternatives have similar climatic factors and values, in regards to temperature, rainfall, relative humidity and others.

Hydrographic: both alternatives have large basins, Magdalena and Catatumbo rivers, with extensive alluvial plains, swamps and other watersheds, albeit Sur de Bolivar has larger hydrographic representation.

Service infrastructure: both alternatives present almost the same deficiencies in basic needs: health, education, communications, transportation, marketing, etc.

Productivity: Spontaneous colonization and migration are present in both alternatives, as well as deforestation, extensive cattle activities. Regions in both alternatives are characterized by extreme poverty, marginality and scant state assistance. These regions have also been stigmatized at the national and international level because of illicit crop cultivation.

Land aptitude: both alternatives correspond to agriculture and cattle activities, as well as transitory and permanent crops.

Socio-cultural: Conditions are different in the two project regions. The cacao tradition is a traditional, strong farming activity in Tibú, while Sur de Bolivar farmers are just entering into cacao crops.

There are also common technical, socioeconomic and socio-cultural conditions and characteristics in both alternatives.

5.2.3 Design of the Evaluation Matrix

The design of the Matrix M-1, included at the end of this section, is based on adaptation and combination of matrix fundamentals of the Leopold Matrix., following USAID and Chemonics requirements. Matrix M-1 also follows the Leontief principles in terms of binary notations (with or without positive or negative notations) and the Jacques Bertin[6] principles relative to groups of variables (interaction).

In Matrix M-1, the first column to the left show a list of activities generated in the project; columns indicate environmental components (elements, indicators) affected by project activities. Crossing a sub-activity with an environmental indicator shows existing possible environmental impact, this is identified with a zero value (0) if it's a negative impact and with 1 if it is positive.

Negative grading depends upon unfavorable or damaging effects caused by the activity over the environmental component. Positive grading depends upon favorable effects.

The fundamental difference in assessing both subprojects is that Tibú has a nursery and will renew old plantations. A possible second phase in Sur de Bolivar subproject is being considered, as the first phase is completed. Plant materials for new cacao plantations will be extracted from these areas.

5.2.4 Results, Environmental Matrix Assessment

The Matrix M-1 include 1,484 cells: 634 cells indicate interactions, 403 positive environmental impacts, and 231 negative impacts. Interactions refer to Assesses Effects (EE): 6 are classified as Assessed Only for Processing (SET); the remaining 850 are Non-Assessed, or cells with no interactions, The table below indicates results obtained.

Table 36. Summary of Identified and Graded Environmental Effects

Effect Type	Positives	Negatives	Total
Cells in Matrix			1.484
Effects Assessed (EE)	403	231	634
Not Assessed (NE)			850
Assessed for Processing (SET) 1/			6

1/ Identified in the socio-cultural component

Assessment of components indicated in columns, based on the Identification Impact Matrix M-1, shows that negative effects are more evident in the Hydric (90), Biotic (58) and Edaphologic (28) components. Positive effects are evident in the socio-economic (176) and socio-cultural (112) components.

Balancing negative v.s. positive impacts indicates that the hydric components continue registering a larger value of negative impacts (-84),followed by the biological component (-18) and geomorphologic (-17). Positive impacts continue appearing in
The socio-cultural (174) and the socio-economic (101) components. The lower value in positive impacts are in the Edaphologic (13) component and Climatic (3).

Results are indicated in table below

.

Table 37. Distribution of Effects by Environmental Components

Environmental Components	Environmental Impacts		TOTALS	BALANCE
	Positive	Negative		
Biotic	40	58	98	-18
Hydric	6	90	196	-84
Edafológico	41	28	69	13
Geomorfologic	11	28	39	-17
Climatic	17	14	31	3
Socio-economic	112	11	123	101
Socio-cultural	176	2	178	174
TOTALES	**403**	**231**	**634**	

The same analysis above, is indicated in project activities (rows), based also in Matrix M-1, shows that the activity with higher positive value is Food Security (80), followed by Marketing Logistics (66), Agro-forestry (65), and Crop Installation and Management (61). Lesser positive impacts include Accompaniment (44), Old plantation Renewal (31), Nursery (29), and Cacao Processing (27).

Negative impacts with the larger values include Agro forestry (-56), Crop installation and maintenance (-47) and Cacao processing (-46). Note that marketing logistics and accompaniment produce positive impacts.

Balancing positives and negatives indicates that the larger negative impact is produced by Cacao processing (-19), followed by the Nursery (-17) and Renewal of old plantations (-17). Net positive affectations indicate the highest value in Food security (69), Marketing logistics (66) and Accompaniment (44). These activities require special

attention by project operators, as they will or not, reflect project success. The PMA includes recommendations for implementation of project activities.

Resulting values are indicated in table below.

Table 38. Distribution of Environmental Effects by Project Activities

ACTIVITIES	Environmental Effects		TOTALS	BALANCE
	Positive	Negative		
Nursery	29	46	75	-17
Crop installation and maintenance	61	38	99	23
Agro-forestry	65	56	121	9
Renewal of old plantations	31	34	65	-3
Cacao processing	27	46	73	-19
Food security	80	11	91	69
Marketing logistics	66	0	66	66
Accompaniment	44	0	44	44
TOTALS	**403**	**231**	**634**	

In preparing Matrix M-1 and establishing the character of each impact in terms of project activity, tables below were used, indicating in global context the elements of judgment to determine each environmental component affected.

The principal critical environmental activities in the cacao project are summarized as follows.

- Improper use and formulation of agrochemicals
- Installation, operation and maintenance of the cacao processing site
- Technological and environmental training
- Marketing of cacao products
- Renewal of old plantations
- Elucidative distribution of food security
- Institutional, labor, community and subversive follow-up

Negative effects caused by project activities may be summarized as follows:

- Water and soils contamination by agrochemical waste and cacao cleaning
- Affectation of plant covering and wildlife by wind agrochemical aspersion and other contaminants
- Affectation of human health by ingestion, inhalation and handling agrochemicals and other contaminants
- State paternalism in distributing food security
- Uncertainties and difficulties in marketing cacao
- Eventual institutional, labor, community ad subversive conflicts

- Eventual generation of disease and accidents caused by use of agrochemicals, transportation and tools

The following conclusions a relative to affectations indicated in Matrix M-1:

Most negative impacts result from improper application and use of agrochemicals. Waste reaches watersheds and remains for many years, reducing metrification (undesirable plant grow in water bodies).

Negative impacts relative to cacao marketing are caused by uncertainty in improvement of land and air transport.

Other negative impacts are socio-cultural concern in adapting to new crop techniques, production in the long-term and marketing of cacao.

Cacao does not appear to be the solution to illicit crop substitution, except in farms less than one hectare. Large landowners are more interested in keeping their land in coca production.

Field surveys indicate that cacao is not represented in Sur de Bolivar, due to high initial investment for installation and maintenance and long wait, up to three years, to yield harvest.

The above socio-environmental connotations may be overcome through education and transference of technology to convince farmers that cacao may be combined with cash and transitory crops.

Some cacao lands should be readapted physical and chemically after illicit crop growing. Periodical soils analyses are necessary to prevent and correct such alterations.

Cacao agriculture fostered by the Colombian Government will favor crop diversification, and stimulate rural dwellers that have long been forgotten by the State. They deserve to be attended and provided for through small but legal farming economies.

Land price valorization will be a positive economic incentive, considering the development impact of the project in regional economies.

5.3 ENVIRONMENTAL ACTION PLAN

5.3.1 Environmental Action System

The basis for the environmental action system is self-commitment allowing self-assessment and improvement of project phases to increase the potential of positive

actions on the environment and minimize actions that affect negatively and contribute to deterioration of the environment.

Adequate environmental action is useful in implementation of management and control measures during cultivation of cacao, and as a tool to increase the potential of project resources, making the project more competitive and contributing to environmental sustainability.

In this order of ideas, producers should understand the importance of environmental action and develop actions and programs recommended in the PMA, at the organization level or in the farm, plantations or association. This will induce farmers to manage and protect natural resources.

Producers should implement clean technologies to minimize negative impacts and to increase the potential of positive impacts, adjusting to their needs and possibilities, technical and economical, and comply with environmental regulations.

The environmental action system phases are framed within:

- Establishment of environmental policies
- Planning
- Implementation and development
- Review and Improvement

At the planning stage, (evaluation and PMA) the following aspects should be examined:

- Determination of necessary natural resources for development of cacao crops
- Definition of activities to be implemented during the operational project phases, and identification of impacts generated
- Establishment of environmental management measures towards decreasing negative impacts on cacao crops

Project planning phases that allowed for a logic approach to decision making included:

Preparation and Diagnosis: Based upon consultation and gathering of information on the natural environment (demand for natural resources), legal requirements and necessary environmental measures for development the cacao project.

Assessment: Evaluation of production characteristics, available resources and expected project benefits.

Management Plan: Proposal of measures towards controlling, mitigating and compensation of possible environmental impacts, previously analyzed and verification of said measures.

The consultant considers that the study phase of preparation of the Environmental Assessment of the cacao project in Sur de Bolivar and Tibú, has been complied with.

The project implementation phase includes application of environmental measures and the productive process to be submitted as part of a sustainable project proposal.

Implementation of these measures need:

Organizational structure to allow for direction, coordination and implementation of a system of environmental action, and assignment of responsibilities.

- Assign resources, procedures, communication flows and operational controls.
- Provide for human resources, physical and financial to meet project goals
- Support acquisition of supplies required for project activities and staff needs, materials, inputs and others.

The project follow-up phase includes verification of efficacy and efficiency of environmental measures already implemented, supported by the following actions:

Monitoring and measurement of key operational characteristics and activities causing environmental impacts.
Define project responsibilities and authority to manage, investigate and correct problems.
Keeping environmental records needed to prove compliance with objectives and proposed goals.

Conduct periodic environmental audits to determine if the environmental action system has been correctly implemented and maintained in accordance with planning standards.

Some of the activities that must be implemented within development of the environmental actions include:

Controlling*:* Consist in inspection and vigilance of plans for implementation of phases of agro-forestry project works, as agreed to by the parts.

Requesting*:* Opportune requests to project operators to solve problems of technical nature, such as phytosanitary control of plantations.

Demanding*:* Compliance of implementation programs of the crop project.

Collaboration*:* Elimination of individual interests between parts intervening in a productive project, seeking mutual collaboration keeping in mind environmental requirements. Field activity is support is key.

Resolution*:* Communication and resolution of concepts between the parts to absolve doubts and difficulties that may come up during implementation of the PMA:

Prevention: re-evaluate agrochemical formulations and adaptability of the species in cash crop projects.

Verification: This activity could be implemented by the Environmental Action Unit and the Environmental Authority. PMA is designed to verify results on site.

Verifications must be carried out periodically on site visiting farms to ascertain project compliance, suggest solutions to problems directly to the project operators. Written reports should be prepared including deficiencies found in the field, addressed to cacao project parties.

The environmental action system must be eminently technical and staff involve should meet this criteria.

5.3.2 Environmental Action Unit, UGA

The UGA will be in charge of supervise compliance with environmental management measures to be implemented according to recommendations in this study.

UGA will guarantee Chemonics that the project activities are implemented in accordance with environmental provisions.

UGA Functions

UGA functions include:

- Planning and implementation of training programs with assistance of the CARs operating in the project zone, the project operator and trade organizations, for staff responsible for implementation of project activities in compliance with PMA plans and programs.

- Motivate project personnel and staff, farmers and operators, to fulfill environmental improvement objectives,

- Maintain continued training programs in environmental themes related to project activities, to create an "environmental culture" within project workers. Staff personnel should know about environmental policies and impacts, actual and potential, functions, responsibilities and potential consequences that may be generated by failing to comply with operative procedures.

- Maintain a registry of documents to evaluate the status of environmental actions. This activity should be based upon monitoring and follow-up registries as defined in the Monitoring and Follow-up Plan in the PMA.

- UGA should input feedback on verification and validation of environmental measures, specially keeping the PMA and Monitoring registries updated. UGA should follow directives issued by trade organizations and research and transference institutions to support transference of technology and environmental manage activities.

- UGA shall establish external communication mechanisms to attend to requests from the community, local authorities, environmental authorities, etc., and internal communication feedback mechanisms to the system, i.e. periodicals, announcement boards, status and progress reports, etc.

- The documental base of the System of Environmental Action comprises the Environmental Diagnostic Report, the Impact Identification and Evaluation Report, the Environmental Management and Monitoring Plan Report, Colombian environmental requirements, USAID reg. 216C, Guideline and instructions on crop management issued by the ministry of the Environment, C.S.B. CORPONOR, FEDECACAO and trade associations.

- Management of documents and registers within the System should foresee activities such as periodical document correction and approvals by authorized staff, practical localization and identification of documents, and continuous updating of same, elimination of obsolete material and availability of new versions.

- UGA should establish work instructions and procedures to control activities that may cause deviations of environmental policies, goals or objectives.

- Procedures for acquisition of goods and services, contracting, in accordance with established guidelines and procedures.

- Verification and control of environmental indicators (emissions, contaminated waste discharges, waste management, etc.) as established in the PMA and the Monitoring and Follow-up Plan.

Verification and Corrective Actions

Verification and corrective actions of measures in the PMA, must comply with guidelines in the Monitoring and Follow-up Plan. UGA shall follow-up procedures to impellent the monitoring plan, based on:

- Responsibility for control, measurement and registration of the monitoring plan.
- A system that allow for verification of compliance with environmental legislation
- Equipment used for taking water and soil samples
- Certifications of calibration and maintenance of equipment

- Monitoring variables (environmental indicators related to environmental policies, objectives and goals
- Monitoring registries

Non-conformity with legal requirements or deviation from established objectives must be registered into an identification system that should at lest, include: foreseen impact, implemented measure, if any, monitoring system or methods used, magnitude and type of impact and responsibility. Recommendations regarding corrective actions and preventive actions should also be included, as well as the control and verification actions following the application of the measure.

The environmental authority shall be in charge of verification compliance with environmental regulations and management measures proposed in the Plan.

Management Review

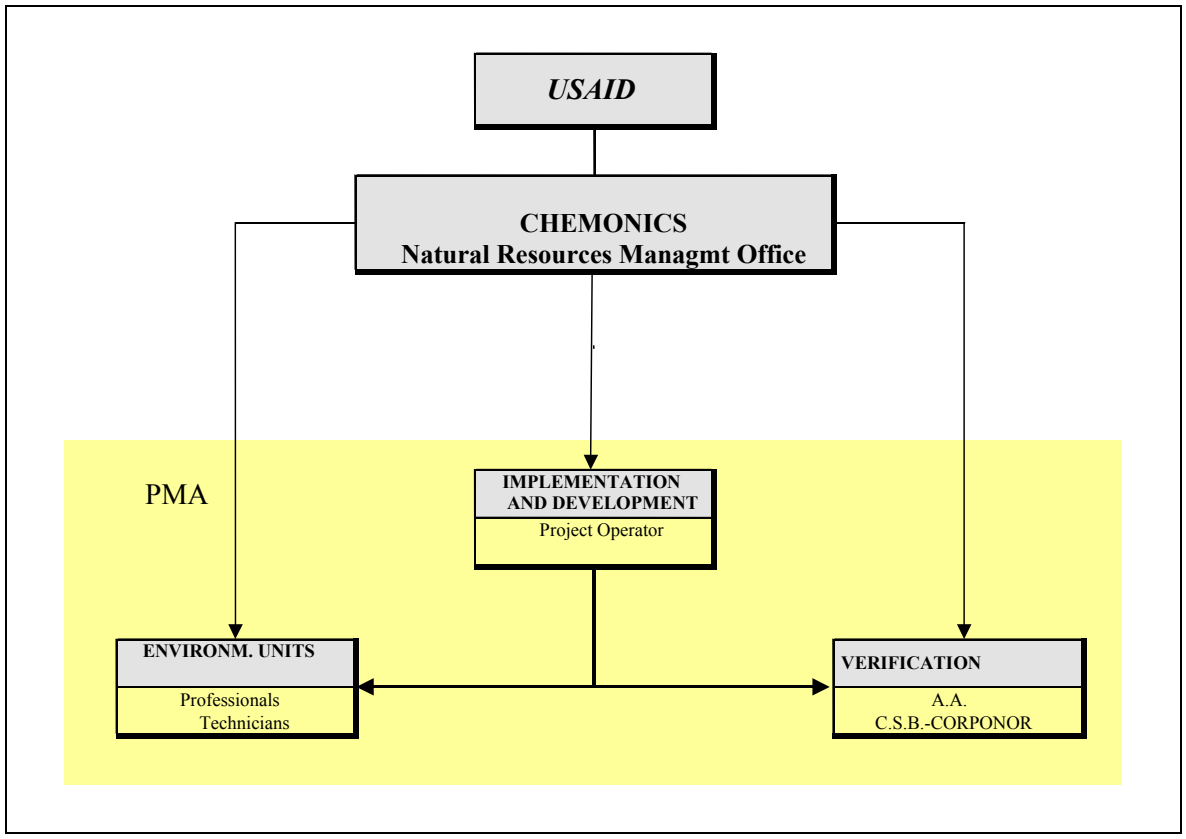
The manager of the Environmental Action System should conduct periodical system reviews, to assure applicability and competence. This review may be carried ot twice in each productive cycle.
Management review should include:

- System action's review
- Objectives and goal results
- Internal auditing reports
- Evaluation of the environmental impacts and measures taken
- Study of improvement proposals
- Establishing new objectives and/or goals
- Approval of improvement actions, assignation of resources and responsibilities

- Structure and Responsibilities

Organizational structure and responsibilities in the Environmental Action System is indicated as follows.

Figure 3 Organizacional Structure of the Environmental Action System



5.4 ENVIRONMENTAL MANAGEMENT PLAN

5.4.1 Background

The Constitution of Colombia of 1991 in Title II, Chapter 3 Articles 79 and 80, refers to environmental rights, and specially to Law 99 of 1993, and regulatory decree No. 1.728 of August 6 de 2002, that in Article 1 defines as "Environmental management Plan the document produced from an Environmental Stable Assessment, describing in detail the actions that will be implemented to prevent, mitigate, compensate or optimize environmental impacts caused during implementation of a project, work or activity, including follow-up , control and contingency plans, according to the nature of the project, work or activity". The Environmental Management Plan is usually prepared in the event that environmental impacts cause damages on natural resources and the environment.

Design of the Environmental Management Plan for the Cacao Project in Tibú and Sur de Bolívar, is based on substitution and eradication of illicit crops and acceptance of new production alternatives, supported by training and transference of technology to cacao crop cultivation, or in an agro-forestry model including forests, plantain and frit trees.

Although the project does not include cacao production in the first phase, recommendations in Environmental Guidelines seek to initiate changing the traditional farming methods, especially in relation to use of agrochemicals.

Organic cacao starts with improved species that can be managed during the phase of cultivation with clean technology, already used by *campesinos*. The objective of this technology is controlling pests and disease.

In consideration to similar ecological and environmental characteristics in the zone of influence of the cacao project, the Environmental Management Plan is formulated for both project zones in Tibú and Sur de Bolívar.

The following project activities were considered in formulation of the PMA (see Matrix M-1)

Activity	Sub-activity
Nursery	1 a 7
Installation and maintenance of cacao crop	8 a 15
Agro-forestry	16 a 24
Renewal of old cacao plantations (optional)	25 a 29
Cacao processing sites	30 a 35
Food security	36 a 43
Marketing logistics	44 a 49
Accompaniment	50a 53

5.4.2 General Objective

Upon completion of identification, qualification and quantification of impacts and assessment of environmental consequences that could be caused by cacao project activities, the principal objective of the PMA was set. Objectives include formulation of mechanisms and recommendations to contributing to prevention, control, and decrease and compensation of damages or benefits caused to the biotic media, the environment and socioeconomic and cultural environmental components

The following are the most important definitions of the measures included in the PMA.

Compensation Measures: include works or activities to compensate human communities, regions and environments for damages caused by negative impacts generated by the project, work or activity, that can not be avoided, corrected, mitigated or substituted.

Control measures: actions designed to maintain original conditions of the environment, affected by the project, work or activity.

Mitigation Measures: actions designed to minimize negative impacts that may be caused by the project, work or activity.

Preventive Measures: include important actions to avoid damages that may be caused by the project, work or activity on the environment.

In addition to the measures indicated above, others complementary measure are needed to guarantee compliance and efficiency, such as supervision, contingency, follow-up and monitoring, quality control and environmental audits.

Environmental Management guidelines are provided at the end of this section, as well as the PMA chronogram.

Pursuing recent requirements by the ministry of the Environment, formulation of environmental PMA measures are presented as Environmental Management Guidelines, to facilitate application of the PMA

The PMA is divided in three major activity groups including management of the physica media, and the biotic and socio-economic project components. Each group has specific activities and guidelines for impact management.

Each program or mitigation measure includes specific factors that may generate environmental impacts, the mitigating measures and strategies for monitoring measures. These include:

- **Measure**

Establishing character of the measure in regards to prevention, mitigation or compensation, depending on then magnitude of the impact.

- **Impact generating activities**

Provides the code of interaction of Matrix M-1 relative to the PMA guideline.

- **Environmental Impacts**

Includes the list of impacts and or environmental effects that must be mitigated upon implementation of PMA measures. This information is extracted from Matrices M-2 to M-8, depending of the environmental component.

- **Design**

Includes designs, if any, and technical considerations to justify the measure

- **Description of measure (s)**

Includes description of actions that must be carried out in each Project activity to avoid, decrease, or lessening effects.

- **Chronogram**

Indicates time of execution of measures.

- **Cost**

Includes the estimated total costs generated by application of resources for implementation of measures. Each Guideline contains the approximate cost of activities and direct costs of management activities, and a breakdown of general PMA costs.

The following are the Environmental Guidelines for environmental control of the cacao project in Tibú and Sur de Bolivar.

MANAGEMENT OF THE BIOTIC RESOURCE

MANAGEMENT OF FLORA	**ENVIRONMENTAL GUIDELINE**	**1**
Generators of environmental impacts: *A1, A2, A4, A8, A10, A12, A16, A18, A20, A22, A23, A26, A28, A30, A31, A33, A35*	**Evaluation Matrix**	**M-2**

Natural elements affected: Flora	**Type of measure:** Preventive, Control, Mitigation

Principal environmental effects

- Loss of plant covering
- Indirect affectation of plant covering in areas adjacent to plantations

Description of measure:

Preventive: - Activities related to nursery germinator and clone garden must be carried out away from water sources. - Apply manual minimal farming methods - Carry out training programs in technological management of agricultural practices and application of agrochemicals - Use contour lines in tracing and plotting holes. - Apply compost fertilizers, less soluble. - use appropriate planning distances, allowing sunlight to reach plants and free air circulation. - Plant clones resistant to disease, pests and common problems in Project zones. - Avoid burning vegetal waste. Control: - Use MIPE in controlling irrigation activities, soil preparation. Mitigation: - Install native plants in the nursery and shading areas. - Maintain plant covering on the soil to Project from erosion. Use dead vegetable matter upon soil in tree rows, such as cane, grass, plantain leaves, weed, etc. Transportation of this materials from sites far from the plantation may be expensive.	- Plant native species, affected by crops in zones away from cacao, conduct soil studies. Timber trees and fruit trees are suggested in an area of 0.25 ha serving 100 cacao farms. - Carry out a Operative Action Plan for multiplication of plant material. Design of planning activities: - Location of plant material: Technicians must guide farmers in selection of planning sites, keeping in mind technical, economic and soil aspects. - Recommended species: Aro, Freno, Caracolí, Guadua, Anaco, Arrayán, Guamo, Guayacán rosado, Cedro, Carbonero, Cucharo, Nogal, Gallinero, Acacia, Grama Sowing: Holes must be dug just before transplanting seedlings. Recommendations: clear planting areas, use excess earth to cover the lower plant stem. Clear cacao processing areas. Fertilize with chicken manure by hand, use 4 cm organic layers. Brak the bag containing the seedling with care, do not harm seedling. Place excess earth near the bottom of the stem. Use local labor.

Cost	**Cost per Ha**
Selection and planting of plant material: (0.25 ha in 100 demo farms in each sub-region	C$ 950.000
Maintenance of species for renewal of old plantations in the dirt year	C$ 300.000

Responsible parties:	**FOLLOW-UP:**	**MONITORING:**
Project operators, UMATA technicians, civil municipal authorities.	Specific plan required? Yes ? X No? Description: Format BT	Requires specific plan? Yes? X No?

WILDLIFE MANAGEMENT	**ENVIRONMENTAL GUIDELINE**	**2**
Environmental Impact generators: *B1, B2, B4, B8, B10, B12, B16, B18, B20, B22, B23, B26, B28, B30, B31, B33, B35*	**Evaluation Matrix**	**M-2**

Type of measure: Preventive, control, mitigation.

Natural elements affected: Wildlife

Environmental impacts:		
- Species flee zones due to crop planting activities - Species are poisoned.	- Loss of terrestrial micro-fauna - Alteration of biological equilibrium of flora and fauna by action of agrochemicals.	- Decreased bird food sources - Offensive smells - Affectation of aquatic species

Description of measures:

Preventive: - Activities related to nursery germinator and clone garden must be carried out away from water sources. - Apply manual minimal farming methods - Carry out training programs in technological management of agricultural practices and application of agrochemicals - Use contour lines in tracing and plotting holes. - Apply compost fertilizers, less soluble. - use appropriate planning distances, allowing sunlight to reach plants and free air circulation. - Plant clones resistant to disease, pests and common problems in Project zones. - Avoid burning vegetal waste. <u>Control</u>: - Use MIPE in controlling irrigation activities, soil preparation. <u>Mitigation</u>: - Install native plants in the nursery and shading areas. - Maintain plant covering on the soil to Project from erosion. Use dead vegetable matter upon soil in tree rows, such as cane, grass, plantain leaves, weed, etc.	Detailed description of activities and Works to be implemented: -Identification of migrant species due to crop activity and destruction of habitat. - Study of climatic and edaphic conditions in zones determined for creation of ecological niches and habitats for migrants from farming areas. - Ecological conditioning of selected areas to harbor migrant species includes: - Planting vegetal species appropriate to the migrant species ecological cycle. - Incorporation of fauna appropriate to the migrant species ecological cycle - Monitoring of area conditions and control over species harbored, including identification of species in the project area. - Annual report on evolution of harboring migrant species, and recommendations on corrective measures.

Cost	**Cost**
Training workshops on local wildlife and management measures (2 in each region)	C$3,000,000

Responsible parties:	**FOLLOW-UP:**	**MONITORING:**
Cacao Project operators, UMATA technicians, civil municipal authorities.	Specific plan required? Yes ? <u>X</u> No? Description: Format BT	Requires specific plan? Yes? No? X

LIQUID WASTE MANAGEMENT	**ENVIRONMENTAL GUIDELINE**	**3**
Environmental Impact generators: *G1, H2, F3, G4, D7, E8, G9, F11, H12, G13, D15, E16, G19, F21, F22, G23, D24, G25, H28, D29, G30, H33, D34*	**Evaluation Matrix**	**M-2** **M-3**
Natural elements affected: water, fauna and soil.	**Type of measure:** Preventive, control, mitigation.	
Environmental Impacts: Contamination of watersheds due to inadequate management of liquid waste Generation of offensive smells due to inadequate management of liquid waste Contamination of water sue to sediments and pesticide, fertilizer waste through seepage.		
Description of measure: Prevention: - Avoid excessive water flow to control loss of soil Control: Temporary storage of liquid waste in hermetic containers (55 gallon drums) in nursery sites and cacao processing areas. Supervise that liquid and solid waste (packing, input and food containers) is deposited in designated places. Burying and/or recycling of excess waste material is recommended Mitigation: -Immediate handling of accidental oil, grease, fuel spills using appropriate tools, cover with a thick layer of earth or sand, pack it (specially in nursery sites)	- Implementation of workshops on liquid waste generated in cacao crop activities and domestic waste. - Application of recommended product dosage according to type and condition of pest or disease. -Disposal of water from clearing and washing tanks may be recycled to use in mixing agrochemicals. Wash sprayers and agrochemical containers three times over. Monitoring and follow-up of works and activities implemented.	

Cost		**Valor**
Workshops on management of liquid waste, 2 per region		$ 3.200.000
Teaching material		$ 850.000
Responsible parties: Cacao Project operators, UMATA technicians, civil municipal authorities.	**FOLLOW-UP:** Specific plan required? Yes ? X No? Description: Format BT	**MONITORING:** Requires specific plan? Yes? X No?

WATER QUALITY AND USE CONTROL	**ENVIRONMENTAL GUIDELINE**	**4**
Environmental Impact generators: *G1, H2, F3, G4, D7, E8, G9, F11, H12, G13, D15, E16, G19, F21, F22, G23, D24, G25, H28, D29, G30, H33, D34*	**Evaluation Matrix**	**M-2** **M-3**

Affected Natural Elements: water, fauna and community	**Type of measure:** Preventive, Control and Mitigation
Environmental Impacts:	
- Decreased water flow - Water flow stoppage - Conflicts over the use of water	- Affectation of water quality - Eutrification processes in rivers and water bodies

Description of measure

Prevention:

- Application of recommended product dosage according to type and condition of pest or disease.
- Disposal of water from clearing and washing tanks may be recycled to use in mixing agrochemicals..
- Wash sprayers and agrochemical containers three times over
- Implementation of MIPE

Mitigation:

Establish alternative potable water supply sources in rural areas in the Project zones, and sewage and effluent treatment
For instance: build latrines and septic tanks (See figures).
Initial construction of 10 storage reservoirs in sub-projects located in selected farms to be used as experimental demos of advantages of having water storage and protection. The reservoir is an spherical segment (looks like an orange section), built on stable soil, the surface is covered with a reinforcing mesh and a protective mortar layer). A filter is installed to relieve pressure, overflow is conducted by a pipe to a ditch

Cost	**Cost per unit**
Construction of ten water storage reservoir	C$125,000
Construction of 10 liquid waste disposal systems	C$350,000

Responsible parties:	**FOLLOW-UP:**	**MONITORING:**
Cacao Project operators, UMATA technicians, and Project beneficiaries.	Specific plan required? Yes ? X No? Description: Format BT	Requires specific plan? Yes? No? X

SOIL MANAGEMENT	**ENVIRONMENTAL GUIDELINE**	**5**
Environmental Impact generators: *L2, J2, J4, J12, L18, J28, L30, L33, L34, L35, N1, O2, O7, I13, O13, M16, M18, O24, O25, O29, M30, O31*	**Evaluation Matrix**	**M-4** **M-5**

Affected Natural Elements: water, air, fauna and flora.	**Type of measure:** Preventive, Control and Mitigation

Environmental Impacts:

- Change in the natural conditions of soil - Affectation of soil fertility Physical-chemical alteration of soil - Alteration of biological equilibrium of micro-flora and micro-fauna due to agrochemicals	- Air contamination by suspended particles - Erosion by wind and water runoffs. - Soil affectation by burnings - Generation of erosion

Description of measure:

Prevention:
- Promote minimum technical farming standards
- Follow contour lines in tracing and plotting tree sites
- Avoid excessive water flows to control soil loss
- Apply compost fertilizers, less soluble.
- Extend plant covering over denuded soils
- Use adequate shading and plant density to allow for sunshine and free air flow
- Conduct pest and disease integrated management and weed control
- Avoid vegetal waste burning. Waste should be transported to open spaces to decompose, later to be used as organic compost, Guideline No. 5.

Control:
- Review intervened areas periodically. Identify results of cultural practices.
- Establish pest and disease follow-up programs to determine pest and disease behavior patterns
- Use recommended product dosages.

Mitigation:
- Keep plant covering on soil to prevent erosion, follow Guideline No. 1
- Apply irrigation according to physical soil condition
- Establish training programs for cacao farmers in cultural practices management for cacao crops and associated crops

Cost	**Total Cost**
Training workshops in soil management (3 in each Project region)	C$4.500.000
Teaching material	C$ 900.000

Responsible parties:	**FOLLOW-UP:**	**MONITORING:**
Cacao Project operators, UMATA technicians, municipal and environmental authorities in the project zone	Specific plan required? Yes ? X No? Description: Format BT	Requires specific plan? Yes? No? X

SOLID WASTE MANAGEMENT	**ENVIRONMENTAL GUIDELINE**	**6**
Environmental Impact generators: *L2, J2, J4, J12, L18, J28, L30, L33, L34, L35, N1, O2, O7, I13, O13, M16, M18, O24, O25, O29, M30, O31*	**Evaluation Matrix**	**M-4 M-5**

Natural elements affected: water soil.	**Type of measure:** Preventive, Control and Mitigation

Environmental Impacts

Affectation of soils by improper solid waste management
Contamination of watershed by inadequate solid waste management
Contamination o fair by improper management of solid waste.

Description of measure

Prevention: - Reduce volume of waste, use compaction and recycling techniques Control: - Locate and identify solid waste disposal areas - Installation of live barriers. Use native trees in the organic waste processing areas. - Collect waste in plastic bags. Take ropes, containers, and other refuse and bury in a designated area in the farm. Packing may be used in compost processes. - Collect all organic material generated in cacao crops and use it for compost	- Caution workers not to use agrochemical containers for food storage. Separate and incinerate all infested material. Follow environmental recommendations. - Separate agrochemical containers fro others plastic containers. - Wash agrochemical and other product containers. Wash three times over Mitigation: - Organize a campaign to teach management of solid waste for farmers and operators of cacao processing areas. Campaign themes: " Reducing solid waste at place of origin", "Design, construction and management of compost, an organic alternative".

Cost	**Unit Cost**
Implementation of a solid waste management system (Compost) 20 farmers groups	C$550.000
Implementation of lice barriers to control offensive smells	C$85.000
Waste management workshops, 2 per region	C$ 750.000
Teaching material and educational leaflets	(Total) C$2.100.000

Responsible parties:	**FOLLOW-UP:**	**MONITORING:**
Cacao Project operators, UMATA technicians, AND MUNICIPAL AND Environmental authorities in the project zone .	Specific plan required? Yes ? X No? Description: Format BT	Requires specific plan? Yes? No? X

AGROCHEMICAL MANAGEMENT	**ENVIRONMENTAL GUIDELINE**	**7**
Environmental Impact generators: *L2, J2, J4, J12, L18, J28, L30, L33, L34, L35, N1, O2, O7, I13, O13, M16, M18, O24, O25, O29, M30, O31*	**Evaluation Matrix**	**M-2** **M-3**
Type of measure: prevention and control		
Natural elements affected: Water, air, flora, fauna, soil and human community		

Environmental Impacts

- Causes death to humans and animals alike
- Carcinogenic and mutagenic agents, affect human reproductive system. Causes alteration on trophic chain and reproductive systems of harmless insects, fish, earthworms, vegetables and small mammals.
- Affects soil by water percolation and absorption.
- Affects flora and terrestrial and aquatic fauna, through wind drift, rain water and runoffs.
- Affects cacao plants by overdoses and ignorance of application of agrochemicals
- Maintenance a crop protection over costs.
- Contributes to eutrofication of water bodies. Contributes to growth of undesirable aquatic plants and accumulation of inert materials.
- Creates resistance to chemicals and fertilizing effects if applied frequently and overdosed. Contamination risks of ambulatory contamination during transportation of product.
- Persistent of chemical effects during long periods of time. Some effects last up to 15 years.

Description of measure:

Prevention

- Training in induction to farming community on the effects and dangers of pesticide use and abuse
- Request technical assistance to learn correct product application and dosage.
- Read, understand and carefully follows product instructions in labels.
- Use special care in handling and transporting agrochemicals. Follow instructions.
- Store products in a safe place, away from people and animals.
- Supply operators with proper safety equipment.
- Provide medical coverage for persons handling agrochemicals.

AGROCHEMICAL MANAGEMENT	**ENVIRONMENTAL GUIDELINE**	**7**

lidentification and application of recommendations:

Identification of insects, weeds or fungi to be eradicated.
- Select appropriate chemical
- Select nozzle type
- Grade aspersers
- Apply recommended dosage

Control:
- Verify authorized agrochemical distributors to purchase product.
- Supervise transportation and local handling of product. Follow instructions and take precautions. Keep away unauthorized persons from applications sites while using product.
- Ascertain that all operators use safety equipment and protective gear.
- Supervise that liquid waste, parking material and containers are stored in a safe place. Bury or incinerate excess waste.
- Operators must undergo periodical medical checks, specially serological and pulmonary examination.

Mitigation:
- Take victims of intoxication and burns produced by chemicals to the closest medical facility right away.
- Pickup spills immediately, cover site with sand or earth.
- Notify neighbors and persons in the area of chemical spill location. Especially if the spill affected a river or water body.
- Select appropriate building to store agrochemicals. Use only exact amounts, leave remaining product safely stored.
- In the event f spills or intoxications or any accident related to use of agrochemicals: remain calm, sep assistance, transport injured and victims to nearest medical facility.

Costs		**Total Cost**
Industrial safety workshops near areas in which agrochemicals will be applied (3 by region)		$ 4.500.000
Construction of 10 storage sheds (A cargo del Project)		
Training in application of agrochemicals (Cost to be borne by project technicians and operator)		
Responsible parties: Cacao Project operators, UMATA technicians, and municipal and Environmental authorities in the project zone .	**FOLLOW-UP:** Specific plan required? Yes ? X No? Description: Format BT	**MONITORING:** Requires specific plan? Yes? No? X

FOOD SECURITY	**ENVIRONMENTAL GUIDELINE**	**8**
Environmental Impact generators: *AA11, AA28, X36, Y36, Z36, AA36, AB36, X37, Y37, Z37, AA37, AB37, X38, Z38, AA38, U23, R36, S36, T36, U36, V36, R37, S37, T37, U37, V37, R38, T38, U38*	**Evaluation Matrix**	**M-7** **M-8**

Natural elements affected: Project beneficiaries	**Type of measure:** Mitigation

Environmental Impacts

- Provision of economic assistance to cacao farmers during development of plantations, unproductive phase.
- Provision of small stock to farmers to assist sustenance until harvest.
- Avoid paternalism.

Description of measure:

Prevention:

Analyze and assess if cash assistance is advisable.
Verify that dietary habits are not altered.
Keep in mind the overall regional socioeconomic structure.
The Project must be business oriented, adjusted to a *campesino* economy

Control:

Supervise forms of payment. Money often disintegrates normal business practices.
Enter into food multiplication pacts (small-stock and fowl raising).
Compensate permanently through participative processes and training adaptation to new demands inherent to the project.
Provide for strengthening farmers associations, interact with similar associations in the region.

Mitigation:

- Establish contact with Indian authorities, explore participation linkages with farmers..
- Abstain from intervening initially in the Project. Development should be a natural symbiosis processes.
- Keep on hand a social work group to assist in solutions to community, family and individual problems
- Assure that the organization process of the cacao growers association is carried out democratically and participative.

Cost	**Total Cost**
Implementation of small-stock pilot projects (10) (Cacao Project complementary activity)	N:A:

Responsible parties:	**FOLLOW-UP:**	**MONITORING:**
Cacao Project operators, UMATA technicians, and municipal and Environmental authorities in the project zone	Specific plan required? Yes ? X No? Description: Format BT	Requires specific plan? Yes? No? X

MARKETING SUPPORT	**ENVIRONMENTAL GUIDELINE**	**9**
Environmental Impact generators: *AA11, AA28, X36, Y36, Z36, AA36, AB36, X37, Y37, Z37, AA37, AB37, X38, Z38, AA38, U23, R36, S36, T36, U36, V36, R37, S37, T37, U37, V37, R38, T38, U38*	**Evaluation Matrix**	**M-7** **M-8**

Natural elements affected: project beneficiaries	**Type of measure:** mitigation
Environmental Impacts Eventual possibility of economic loss. Uncertain marketing or unsatisfactory Bad years and low prices Product losses and marketing problems Insufficient production training.	Low competitiveness Emergent social and economic problems among cacao growers. Persistence and intensification of security problems in the region. Generation of labor conflicts between producers and laborers. Eventuality of accidents and labor diseases.

Description of measure

Prevention:

Plan production and marketing processes, based on cacao market conditions.
Adapt cacao products to national and international market trends.
Do not flood markets with surplus production.
Program product transportation and marketing with participation of the community.
Produce and prepare product according to quality control standards.
Implement training and transfer of technology programs, in accordance with productive processes
Design and adapt models of rural administration.
Explore new production techniques and processes.
Structure technical assistance programs responsive to *campesino* logia and local conditions in Tibú and Sur de Bolívar.

Control:

Analyze cacao market behavior periodically..
Attend to Quality Control Standards.
Learn minimum and maximum market requirements
Improve land transportation to market centers.

MARKETING SUPPORT	**ENVIRONMENTAL GUIDELINE**	**9**

Review, adjust and update agreements and conventions between producers, workers and buyers.
Keep attendance records in training and technology transference programs, arrange for discussions in other themes..
Supervise and evaluate workshop and technology transference programs results.
Keep an updated census and supervision of eradicated illicit crop areas.
Keep records on visits and activities in the Project zone.

Mitigation:
Explore and analyze new productive alternatives.
Conduct market research in different segments of cacao trading
Find other markets and destinations for your product.
Guarantee and keep commitments on market delivery and volumes.
Learn about environmental requirements applicable to product storage, transport and commercialization.

Cost		**Total Cost**
Commercial support plan and assistance to growers (to be implemented by the Project sponsor and trade associations)		N.A.
Responsible parties: Cacao Project operators, UMATA technicians, trade organizations and municipal and Environmental authorities in the project zone .	**FOLLOW-UP:** Specific plan required? Yes ? X No? Description: Format BT	**MONITORING:** Requires specific plan? Yes? No? X

TRAINING	**ENVIRONMENTAL GUIDELINE**	**10**
Environmental Impact generators: *AA11, AA28, X36, Y36, Z36, AA36, AB36, X37, Y37, Z37, AA37, AB37, X38, Z38, AA38, U23, R36, S36, T36, U36, V36, R37, S37, T37, U37, V37, R38, T38, U38*	**Evaluation Matrix**	**M-7** **M-8**

Natural elements affected: project beneficiaries	**Type of measure:** Mitigation
Environmental Impacts Eventual possibility of economic loss. Uncertain marketing or unsatisfactory Bad years and low prices Product losses and marketing problems	Low competitiveness Emergent social and economic problems among cacao growers.

Description of measure

Workshops will be held to promote economic advantages of the Project and incentive the entrepreneurial attitude of farmers towards productive projects, such as cacao. The following workshops are planned.

1. INTRODUCTION WORKSHOP (22 hours): - Self –stem and human relations - Intra-family relationship - Organization and Citizen's participation. - Solidarity and team work 2. TECHNICAL ASSISTANCE AND FAMILY ORIENTATION WORKSHOP (9 hours): - Instruments for social change and development of attitudes. - Management Capacity and entrepreneurial vision. 3. ENTREPRENEURIAL VISION WORKSHOP (24 hours): - Development of the entrepreneurial spirit. - Micro-enterprise sector policies. - Characteristics of entrepreneurial personality. - Administration principles.	4. BASIC AND APPLIED MATH WORKSHOP (24 hours): - Basic math applied to enterprises. - Inventory. 5. COST ACCOUNTING WORKSHOP (24 hours). - Simple accounting system. - Financial statements. 6. MARKETING AND PROJECTS WORKSHOP (32 hours): - Marketing. - Market research. - Productive projects

<table>
<tr><td colspan="2"><u>TRAINING</u></td><td>ENVIRONMENTAL GUIDELINE</td><td>10</td></tr>
<tr><td>7. TUTORING AND TECHNICAL ASSISTANCE WORKSHOP (17 hours):
- Preparing inventories.
- Production cost calculation.
- Implementation of accounting systems.
- Marketing.
- Productive projects.</td><td colspan="3">8. ORGANIZATIONAL CULTURAL WORKSHOP (16 hours):
Citizens living together.
- Community self-motivation.
- Communications.

9. COMMUNITY ORGANIZATION WORKSHOP (26 hours):
- Associative forms.
- Legal aspects.</td></tr>
<tr><td colspan="2">Costs</td><td colspan="2">Total Costsr</td></tr>
<tr><td colspan="2">Implementation of nine orientation and training workshops (2 sub-regions) (Activity to be implemented jointly by the project implementing agency, Fedecacao and other organizations in the region)</td><td colspan="2">N.A.</td></tr>
<tr><td>Responsible parties:
Cacao Project operators, UMATA technicians, SENA and municipal and Environmental authorities in the project zone
.</td><td>FOLLOW-UP:
Specific plan required? Yes ? <u>X</u>
No?
Description: Format BT</td><td colspan="2">MONITORING:
Requires specific plan? Yes?
No? X</td></tr>
</table>

ENVIRONMENTAL EDUCATION	**ENVIRONMENTAL GUIDELINE**	**11**
Environmental Impact generators: *AA11, AA28, X36, Y36, Z36, AA36, AB36, X37, Y37, Z37, AA37, AB37, X38, Z38, AA38, U23, R36, S36, T36, U36, V36, R37, S37, T37, U37, V37, R38, T38, U38*	**Evaluation Matrix**	**M-7** **M-8**
Natural elements affected: Project beneficiaries	**Type of measure:** Mitigation	

Environmental Impacts
Lack of information on environmental Project sustainability requirements
Generation of labor conflicts between producers and laborers.
Eventuality of accidents and labor diseases.

Description of measure:
Several workshops will be held in the Project region to generate environmental awareness among farmers.

Workshops will be oriented towards:

Cycle of four (4) workshops to target population on the importance and protection of then ecosystem.

Cycle of four (4) workshops to target population on the PMA components.
Technical assistance to target population by local environmental authorities..

Establishing education and awareness programs in rural schools and Community Action Boards on problems regarding water sources contamination and the need to improve hygiene habits and use of water.

Project participants should be urged to attend workshops and participate in discussions at meetings.
Themes for discussion include:

Environmental components of ecosystems such as soil, air, wind, flora, fauna, forestry resources and human resource
Basic informative and teaching material should be on hand, visual aids, posters, photographic material, specially aerial photographs taken at different times
Waste management, reforestation, and watersheds in the Project zone, housing improvements.

ENVIRONMENTAL EDUCATION	**ENVIRONMENTAL GUIDELINE**	**11**

-Discussions should emphasize the need for solidarity in the theme of natural resources in the Project zone. Avoid selfish attitudes between members of associations and the community.
- Farmers should be instructed on basic environmental legislation like Law 99 of 1993 pointing out their responsibilities towards contamination to water, soil, air, in the project zone or outside; not allowing actions against flora and fauna, control over hunting and fishing inside and outside the project zone, useless destruction of trees and vegetation, damages to infrastructure and public services.
-Ordenamiento Territorial is an important theme for discussion. Its importance as a tool for local and regional planning should be stressed. Regulations on the Plan for protection of soils and uncontrolled use should also be stressed.

Costs		**Total Cost**
Implementation of eight (8) environmental education and natural resources workshops (4 per sub-region)		C$ 6.000.000
Teaching material		C$ 2.400.000
Responsible parties: Cacao Project operators, UMATA technicians, SENA and municipal and Environmental authorities in the project zone	**FOLLOW-UP:** Specific plan required? Yes ? X No? Description: Format BT	**MONITORING:** Requires specific plan? Yes? X No?

INDUSTRIAL SAFETY	**ENVIRONMENTAL GUIDELINE**	**12**
Environmental Impact generators: *AA11, AA28, X36, Y36, Z36, AA36, AB36, X37, Y37, Z37, AA37, AB37, X38, Z38, AA38, U23, R36, S36, T36, U36, V36, R37, S37, T37, U37, V37, R38, T38, U38*	**Evaluation Matrix**	**M-7** **M-8**

Natural elements affected: Project beneficiaries	**Type of measure:** Prevention
Environmental Impacts - Eventual economic loss - Emerging social and economic problems among cacao growers. - Persistence and intensification of public conflicts in the Project region	- Labor conflicts between producers and workers. Affectations to third parties and private property, external to the project - Possibility of accidents and sickness related to Project farming activities in Project sites.
Description of measure: - Compliance with social security regulations - Lectures on preventive health - Provision of safety gear to operators. - Prepare manuals on operation of equipment and tools for safe use. - Train farmers in storing tools in a visible and orderly manner	- Work vehicles in the field should have acoustic protection gear installed. - Project operators should implement basic safety Standard and occupational health measures. - Project operators should stress to farmers the requirement to wear safety gear and protective clothes at all times. - Implement procedures to assure adequate and proper handling of fuels and lubes in vehicles contracted for farm activities or personal use.

Costs	**Total Cost**
Industrial safety workshops(2 per region)	C$ 3.000.000
Teaching material	C$1.000.000
Industrial safety elements	C$9.375.000

Responsible parties:	**FOLLOW-UP:**	**MONITORING:**
Cacao Project operators, UMATA technicians, and project beneficiaries.	Specific plan required? Yes ? X No? Description: Format BT	Requires specific plan? Yes? No? X

5.4.3 Emergency Plan

- **Introduction**

Accidents and disease are likely to occur during implementation of project activities, as well as undesirable disturbances and events beyond PMA regular control. A Emergency plan is needed to attend to emergencies and provide for actions that lessen the effects caused on the community and the environment.

Generally speaking, any activity subject to risk in the project, no matter how remote the risk may seem, requires planning to deal with emergencies and events affecting humans, materials and the environment.

The Emergency Plan includes procedures than incorporate physical personal and financial, elements, to provide reactions to control or reduce damages, timely and efficiently.

- **Description of emergencies**

Emergencies that may occur during implementation of the cacao Project include:

1) **Fires:** Fires may occur in fuel and flammable material storage areas and handling dangerous products.

2) **Accidental spills of toxic substances:** during handling or application, or car accidents. Some of these substances may be agrochemicals, fuels, etc.

3) **Vehicular accidents:** Injured and dead persons, other casualties.

4) **Natural phenomena:** floods, high winds, or earthquake (remote), affecting buildings and high structures and crops.

5) **Community displeasure:** reactions to taxes and levies, valorization taxes, deficiencies in the food security program or poor road condition.

6) **Civil disturbance:** presence of illegal armed groups in the project zone.

- **Emergency response procedures**

Response actions and procedures to attend to emergency situations include all actions necessary to overcome the emergency and reduce or minimize affectations and damages.

These actions may be carried out by trained teams that will be responsible for emergency control, including logistics.

Creation of these teams is facilitated under Law 48 of 1986 that established the National System for Disaster Prevention and Attention in Colombia.

Nevertheless, cacao project authorities need to conform, train and prepare teams in charge of response to emergency situations, or request the assistance of the National System, as necessary. The National System operates in close contact and cooperation with regional Colombian Red Cross centers, Civil Defense, Defensoría del Pueblo and Fire Departments.

Responsibilities of the project emergency team unit include:

Rapid response to attend to emergencies: This implies that response capacity built within the team, attention to damages to human health and the environment depends of immediate response by the team to the situation.

Designation of responsibilities: teams should have clear understanding of their responsibilities to each team member.

Fast response group: this group is conformed by the Team Chief, a coordinator and at least five assistants (*socorristas)* acting through local authorities in the event of an emergency.

Persons responsible for the cacao project should constitute the emergency response team. This includes training and specific formation of team members to attend to emergencies. The cacao project person in charge, or his/her designee may act as team Chief Coordinator.

- **Prevention of accident risks**

The following is a list of activities related to prevention of risks in the cacao project that may result in emergencies during implementation of project activities.

- Periodic maintenance of farm tools, equipment, machinery and other tools used in Project activities.

- Faulty and defective equipment and tools should be discarded until the elements are properly repaired and satisfactory operation is verified.

- Verification on site of adequate and safe operation of farm equipment, carrying out periodical checks.

In regards to personnel management, workers should visit health centers for periodic examinations.

Use of protective gear and industrial safety elements is mandatory to all personnel involved in farm project activities.

Environmental project costs should include costs of prevention of accidents and disease.

- **Disaster management program**

Occurrence of events caused by anthropic and/or natural intervention affecting the project economic equilibrium or worse, human life, may happen during the life of the project. A disaster management program will provide instructions and guidance to attend to disaster and emergency events.

- **Emergency Program objectives**

To structure a follow-up emergency and disaster plan, through logical sequential-planning of activities that should be carried out in the event of a disaster or emergency.

- **Description of actions**

Procedures to be applied in the event of emergencies:

1) Activate action plan and decision making process
2) Define procedure to be followed in the emergency plan
3) Attend to emergency
4) Assess damages; establish mitigation, restoration and compensation measures to be charged to the Project, in the event of emergency.

a. Action plan and decision making process

The Action Plan and decision making processes are indispensable tools in management of emergencies, providing guidelines and actions in the event of an emergency or natural or intentional disaster.

b. Action plan procedures

The emergency reaction team director will order to activate or not activate the plan upon receiving news of an emergency, after analysis of the initial situation.

If the decision is to go ahead and activate the plan, human, financial and logistic resources will be assigned to attend to the emergency; the emergency assessment will be carried out in coordination with the Environmental Supervisor. Actions taken will be reported to the regional environmental authority.

c. Actions to control emergencies

Emergency-trained personnel is needed to control emergencies and displaced to the emergency reported location

d. Damage assessment and implementation of mitigation measures

Damage and assessment of compensation to victims is done after the emergency is resolved, as well as determination of causes and responsibilities. The type of event (direct intervention or natural causes), magnitude and affected area (local or regional) must be determined.

Project authorities are responsible for attending to emergencies, with assistance provided by the Environmental Supervisor, and local and regional authorities, as well as the community, as necessary.

The cacao project should have the following equipment installed on site to attend to emergencies:

1) Communications equipment: cellular phones, radiotelephone, beepers, etc., to maintain communications with local and regional authorities and operating emergency units.

2) First aid equipment and list of medical support and fire departments.

3) Industrial safety equipment, fire extinguishers, and protective gear.

- **Summary of Emergency Action Plans**

Fire

- Turn on the alarm system to activate the emergency plan.
- Displace response teams to the site of the emergency.
- Evacuate personnel from the affected area. Secure the area.
- Use fire-fighting equipment.

Spills

- Turn on the alarm system to activate the emergency plan.
- Take victims to the nearest medical facility
- Contain spills, prevent liquid spills from reaching water bodies, homes and installations
- Build a spill-retaining barrier using earth or sand to contain spill, proceed cleaning and decontamination activities
- Identify the type of substance spilled and advise the plan coordinator to assess damages and determine the origin of the emergency, and the consequences and preventive actions taken

- Notify project beneficiaries of the cause of the emergency and the actions taken deal with the emergency

Vehicular Accidents

- Turn on the alarm system to activate the emergency plan.
- Activate alarm and notify the emergency to the emergency plan coordinator and to the emergency response team.
- Proceed with rescue operations and render first aid to victims, coordinate transportation of victims to nearest medical facilities (Tibú, Cúcuta, Santa Rosa, Simití, San Pablo or Barrancabermeja).
- Prepare reports on the emergency, assess damages and consequences to avoid future occurrence.
- Collaborate in preparation of documentation of indemnities, insurance claims, etc.

Natural Phenomena

- Turn on the alarm system to activate the emergency plan.
- Activate alarm and notify emergency to the plan coordinator and the response team.
- Direct rescue teams to the site of the emergency, provide salvage equipment, notify fire department.
- Proceed with rescue operations and render first aid to victims, coordinate transportation of victims to nearest medical facilities (Tibú, Cúcuta, Santa Rosa, Simití, San Pablo or Barrancabermeja).
- Prepare reports on the emergency, assess damages and consequences, assess response.

Community Unrest

- Turn on the alarm system to activate the emergency plan.
- Activate alarm and notify emergency to the plan coordinator and to the emergency response team
- Establish a committee to initiate dialogues with the community and listen to complains.
- Explain project benefits, give concrete examples in similar projects
- Establish agreements with the community to resolve issues in the short-term, ascertain participation of the community in problem management and project authorities.

Disturbances

- Turn on the alarm system to activate the emergency plan.
- Activate alarm and notify emergency to the plan coordinator and the emergency response team
- Notify the status of the emergency to civil and environmental authorities
- Search for victims on site. Take victims to nearest medical facilities (Tibú, Cúcuta, Santa Rosa, Simití, San Pablo or Barrancabermeja).

- Establish causes of disturbance and disaster, and determine responsibilities

- Cost of the Emergency Plan

The cost of the emergency plan is show in table below.

Tabla 39. Estimated Costs – Emergency Plan

Item*	Quantity/Unit	Unit Cost ($)	Total Cost C$
Intoxication	N.A.	N.A.	5,000,000
Burns	N.A.	N.A.	3,000,000
Hospitalization	N.A.	N.A.	20,000,000
Ambulatory treatment	N.A.	N.A.	10,000,000
Medicines	N.A.	N.A.	1,000,000
TOTAL COST			39,000,000

*The Emergncy Plan is an eventuality, as such, estimates are not accurate

- **PMA Costs**

The Environmental Management Plan costs are indicated in the Environmental Guidelines. These costs apply to one-year project operation in the two project regions.

Please note that under the PMA, the cost of operation of the UGA is provided for.

5.5 MONITORING AND FOLLOW-UP PLAN

5.5.1 Introduction

The Monitoring and Follow-up Plan (PSM) is part of the PMA, serving as a management tool for determining compliance of program goals, objectives and indicators, to allow for verification, supervision and assessment of project activities before, during and after project implementation.

The PSM collects environmental information to determine crop behavior, including crop processing activities. PSM provides criteria to facilitate decision processes on unforeseen situations, to minimize negative environmental affectations and to guarantee technical analysis and solution of potential conflicts between farmers, project operators and the environmental authorities, in interpreting environmental project issues.

5.5.2 General Objectives

To provide technical basis for verification of project development to environmental authorities, participant communities, Chemonics and USAID.

5.5.3 Specific Objectives

PSM will establish activities and responsibilities to verify, supervise and assess actions and works included in the PMA.

PSM will establish sites for taking samples, as indicated in the Environmental Assessment Study, to increase trust in results and comparative assessments.

PSM will establish detailed indicators and monitoring sites, as well as technologies recommended for managing samples, including periodicity, duration, analyses and assessment procedures; the cost of the PSM is also indicated.

PSM will indicate procedures for submission of reports and present progress reports on the following activities:

- Physical-chemical monitoring of water bodies intervened by the project
- Progress in fauna and flora management programs
- Progress in management of solid waste programs
- Progress in community programs

A proposal will be submitted to Chemonics and the environmental authority to launch the Environmental Monitoring and Follow-up Management Plan, including the following elements:

- Environmental components to be monitored
- Impacts controlled
- Chronogram
- Type of monitoring

Follow-up and management control should be supported by Chemonics as part of the cacao project through the UGA.

The environmental regional authority will validate monitoring and follow-up activities carried out by the UGA.

5.5.4 Procedures

Tables indicating aspects to be controlled are provided to facilitate verification of compliance by the environmental authority, according to affected components (physical, biotic or socioeconomic)

Project follow-up procedures include the following phases and contents:

- **Collection of information**

Gathering information and processing results of application of environmental measures indicated in PMA, using the Environmental Guidelines.

- **Periodicity**

PMA follow-up must be conducted periodically to keep (two weeks intervals suggested)updated information.

- **Interpretation**

Information on efficacy and environmental quality of applied measures are compared with previous report ratings. Interpretation of variances and objectives provide for determining conclusions in regards to project success or need of adjustments in the PMA.

- **Implementation**

Project follow-up should provide simple, true and authentic answers using the PMA and PIPMA forms. Answers should a simple Yes or No, example follows:.

Environmental Management Measures	Yes	NO	Comments
Did you attend the first workshop on management of agrochemicals?		X	
Did you attend the organizational culture workshop?	X		
Do you follow technical assistance recommendations in agrochemical applications?		X	
Do you recycle or bury solid waste?		X	

Final processing of forms is carried out in office, including comments and findings.

Some examples of headings and format for the cacao project are included below. These include relevant information on biotic, hydric and edafologic components, registering the highest negative effects, and socio-economic and socio-cultural components corresponding to the highest positive effects.

Table 40. Sample for PMA Monitoring and Follow-up, Biotic Component

PMA Monitoring and Follow-up Register. Cacao Project			
Responsible:	**Place:**	**Date:**	
BIOTIC COMPONENT			**BT**
Environmental Management Measure	**Yes**	**NO**	**Comments**
Do you use integral PEM control?			
Do you dispose removed plant material adequately?			
Do you use plant covering?			
Do you remove agrochemicals away from homes and cacao crops?			
Have you noticed any affectation of the natural landscape?			
Are there any problems related to flora and fauna species that may have been poisoned due to application of agrochemicals?			
Have you noticed evidence of activities that scare wildlife away from plantations?			
Do you carry out germinator, nursery and clone garden activities far from water sources?			
Preparer UGA)	*Reviewed by (Environmental authority)*		

PEM = **Pests**, **Disease** y **Weeds**.

Table 41. PMA Monitoring and Follow-up Register, Physical component

PMA Monitoring and Follow-up Register. Hydric Component			
Responsible:	**Place:**	**Date**	
HYDRIC COMPONENT			**HD**
Environmental Management Measure	**YES**	**NO**	**Comments**
Do you perform physical-chemical and bacteriological analysis of water quality?			
Do you separate sewer effluents from liquid waste originated in cacao processing sites?			
Do you control the use of water?			
Have you noticed any affectation to the natural drainage			
Have you observed unusual growth of aquatic plants and/or clogging of water bodies?			
Have you requested your farm advisor to provide assistance in determining dosage , time and frequency of application of agrochemicals?			
Do you conduct any form of treatment of effluents before discharging into rivers or creeks?			
Preparer UGA)	*Reviewed by (Environmental authority)*		

Table 42. PMA Monitoring and Follow-up Register, Edafologic Component

PMA Monitoring and Follow-up Register			
Responsible:	**Place:**	**Date:**	
EDAFOLOGIC COMPONENT			**RS-ED**
Environmental Management Measure	**SI**	**NO**	**Comments**
Do you practice minimal-farming activities manually?			
Have you asked for quality tests of physical-chemical conditions of soils?			
Have you noticed any changes in the use of soils in nearby farms			
Do you follow slope contours in locating hole sites for seedling sowing?			
Do you avoid excessive water flows in order to control erosion?			
Do you implement any pest, disease or weed control programs?			
Have you observed loss of soil covering?			
Have you noticed erosion, cave-ins or landslides?			
Have you noticed any physical-chemical alterations of soils after application of agrochemicals?			
Have you noticed any evidence of contamination of soil due to inadequate management of solid waste?			
Do you conduct irrigation according to physical conditions of soil?			
Do you reduce waste volume through compaction or recycling?			
Preparer UGA)	*Reviewed by (Environmental authority)*		

Table 43. PMA Monitoring and Follow-up Register, Socioeconomic component

PMA Monitoring and Follow-up Register			
Responsible:	**Place:**	**Date:**	
SOCIOECONOMIC COMPONENT			**SE**
Environmental Management Measure	**YES**	**NO**	**Comments**
Do you think that cash assistance is a good idea?			
Have you entered into dietary diversification arrangements, like chicken and small-farm animal raising?			
Is there any evidence of community participation in Project activities?			
Is there any improvement in life conditions of project participants?			
Do you notice any changes in relationships between the community and the Government?			
Have you noticed if there any evidence in improvement of family incomes derived from the project?			
Have you received any assistance in marketing farm produce?			
Have you noticed any evidence of higher demands for jobs?			
Has the product (cacao) improved as a result of application of new technologies over old ones?			
Preparer UGA)	*Reviewed by (Environmental authority)*		

Table 44. PMA Monitoring and Follow-up Register Socio-cultural Component

PMA Monitoring and Follow-up Register			
Responsible:	**Place:**	**Date:**	
SOCIO-CULTURAL COMPONENT			**SC**
Environmental Management Measure	**SI**	**NO**	**Comments**
Do you attend to training workshops on PEM control?			
Are farmers receptive to training in crop management ?			
Are farmers promoting project benefits?			
Do you receive technical training in crop management?			
Are there any intentions among farmers in your area to go back to or continue to engage in illicit crops?			
Is there any awareness in the importance of management of natural resources?			
Is there a Social Work Group in your community to attend to problems and find solutions?			
Preparer UGA)	*Reviewed by (Environmental authority)*		

100% YES answers to above questions , specially in biotic and hydric components, indicate excellent compliance with PMA precepts. For other components, a margin of tolerance of 80% is acceptable, indicating satisfactory compliance.

- **Monitoring Parameters**

Additional monitoring is required if the results of analysis of water and soil samples during two or three periods, indicate readings above permissible limits.

Additional analyses may be warranted, depending on results of PMA and PEM controls:

- **Soil Analyses**

Recommended analysis of soils follows:

Type of Analysis	Unit Cost ($)	IVA (C$)	Total Cost (C$)
Q-01: Characterization of cationic change capacity, calcium, magnesium, potassium, sodium, change aluminium, base saturation, organic carbon, texture, pH, and recommendations	25.000	4.000	29.000
Q-02 = (Q-01), plus minor elements (iron, manganese, zinc, copper, boron); nitrates, ammonia, electric conductivity and recommendations.	76.000	12.160	88.160
Q-03 = (Q-01),), plus minor elements (iron, manganese, zinc, copper, boron), sulfur and recommendations. ;	59.000	9.440	68.440
Q-04 = (Q-01), plus minor elements (iron, manganese, zinc, copper, boron); total nitrogen and recommendationsns.	59.000	9.440	68.440

Source: IGAC, Cotización 019921 de Diciembre 4 de 2002.

Analysis Q-02 is recommended for the cacao project, includes additional nitrogen values. Number of samples will be determined at random: one at the beginning of the farming cycle, and another at the end of the first year after sowing. I30 lots will be selected for testing in each zone, i.e. 120 soil analyses, 60 in the first year and 60 in the second year.

- **Water analysis**

Type of Analysis	Unit Cost ($)	IVA (C$)	Total Cost (C$)
Physical-chemical characterization: cloudiness, color, total iron, pH, total hardness, magnesium hardness, calcium hardness, chlorides, ammonia nitrogen, nitrites, nitrates, manganese, sulfates, total solids, total solids dissolved, solids in suspension, solids as sediments, orthophosphates and CO2.	70.000	11.200	81.200
Bacteriological characterization: total choliform, feces.	20.000	3200	23.200

Source: ILAM Ltda.. Cotización de Diciembre de 2002

Estimated cost of analysis above is C$104,400/sample

Water quality control(physical-chemical and bacteriologic) should be carried out periodically (maximum within a year). The first analysis is regarded as the benchmark to compare with following analyses over the life of the project.

Five bodies of water are suggested to be analyzed for water monitoring purposes, analyses should be done twice a year. This means that during the 3-year life-span of the project, 60 analyses would have been carried out.

- **Activities**

The following are suggested activities for implementation of the Project Monitoring and Follow-up Plan.

1. Environmental component to be monitored	Hydric, Edafologic and socio-economic
2. Environmental impacts to be controlled	Contamination of water, soil and socioeconomic maladjustments
3. Chronogram:	Biannual or annual, depending on PMA results
4. Type of measure:	Control and mitigation
5. Location	Municipalities of Sur de Bolívar and Tibú.
6. Testing parameters	Water, soil and socioeconomic levels
7. Responsible party:	Environmental Action Unit, UGA
8. Verification:	Regional Environmental Authority (CSB o CORPONOR)
8. Cost of Monitoring and Follow-up Plan	C$15,777,600/year for two regions (project zones)

6 Cost

The cost of the Monitoring and Follow-up Plan was estimated following the proposed methodology in the Environmental Guidelines of the PMA.

PMS costs refer to collection of samples and laboratory analyses of water and soil quality, direct cost of photographic registries and reports.

7 Chronograms

A Gantt bar-diagram was prepared for illustrative purposes, indicating parallel activities in the Environmental Management Plan and the Monitoring and Follow-up Plan. Time frames are given for each monitoring, follow-up or assessment activity.

SECTION 6 LIST OF PREPARERS

The work team that prepared this Environmental Assessment included the following consultants:

- GUSTAVO ROJAS Civil Engineer, Director of the Study.
- JORGE RONDON, Sociologist, in charge of social aspects.
- CLAUDIA RODRIGUEZ, Biologist Specialist in Environmental Assessment, in charge of biotic aspects (flora, fauna) and formulation of environmental management measures.
- GONZALO RICARDO, Forestry Engineer, in charge of technical aspects.
- BENJAMÍN MEDINA. Agricultural Engineer, in charge of technical aspects of the project, use of soil, production, etc.
- JORGE MORENO, Economist, Specialist in environmental economics, in charge of economic aspects and economic assessment.
- FABIAN E. CERON M. Civil Engineer, M.S. in Environmental Engineering. Technical support in characterization of the base-line and formulation of management measures.

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ADDENDUM 1 INTEGRATED PEST AND DISEASE MANAGEMENT PLAN (MIPE)

ALTERNATIVE DEVELOPMENT PROJECT FOR CACAO CROPS IN SUR DE BOLIVAR AND NORTE DE SANTANDER (TIBU)

ENVIRONMENTAL MANAGEMENT PLAN

1.0 Objectives

Phytosanitary pest and disease control is an important component of integral cacao management, along with climate, soil, seedlings, genetics and administration. This combination is fundamental in productivity and profitability of cacao crops.

A second project objective is to reduce conditions that favor the presence of diseases such as fungi, and pests such as rodents and insects, by exerting pest, disease and weeds control. This process begins at the project planning and crop installation phases, using methods and clean technology, preferable, to control pathogens, avoiding damage to other species.

2.0 Affected natural elements

Flora and Fauna

2.1 Type of Measures

Prevention, Control and Mitigation

2.2 Environmental Effects

- Contamination of areas and natural systems by discharge and overdose of agrochemical products that will affect the community and benefic organisms.
- Indirect affectation to plant covering near or adjacent to cacao farms
- Alteration of the quality of water resources
- Incorporation and/or bioaccumulation of substances and organisms in the food chain

2.3 Description of Measures

2.3.1 Control Measures

a. Identification of insects and disease

- Insect Management:

  → Identify type of insect in crops
  → Find out the preferred crop egg-nesting grounds
  → Find out the time of year in which insects become abundant in great numbers
  → Find out what part of the crop is eaten by insects

- Disease management:

  → Find out favorable environmental conditions that allow for formation and penetration of disease
  → Find out nutritional crop conditions
  → Find out action pathogen's mechanisms
  → Find out behavioral characteristics of substances that may be used to plant strengthen defense mechanisms

There are few pests that attack cacao crops. The following is list of such pests:

- Moniliasis (*Moniliophthora roreri*)
- Witches' broom (*Crinipellis perniciosa*)
- Brown cob rot and stem cancer (*Phytophthora spp*)
- Machete disease (*Ceratocystis fimbriata*)
- Star wound (*Rosellinia pepo*)
- Yellow mite (*Monalonium dissimulatum*)
- Red mite (*Monalonium annulipes*)

b. Identification and assessment of pest mortality factors

c. Identification and assessment of plant natural enemies

Use biological products to control plant affectations that may act as insecticides, appetite suppressors, egg laying disorientation, repellents or growth regulators. A good example of organic products are derivates from the Nim tree, a Meliaceae species.

d. Establishment of low-weed crops for pest natural controls

Recently, low-weeds and other native shrub buffer zones that serve as natural shelters and sources of food to beneficial insects are being used in long-life (over tree years) tree plantations.

It is important to know genetic material in order to protect it. Therefore, flora and native fauna research of species living in forest areas linked to cacao fields, is vital. Indiscriminate use of pesticides, specially herbicides and insecticides, often cause drastic effects eliminating beneficial insect populations.

Some vegetal species attract beneficial insects, this condition is being applied in some pest management projects. The following is a short-list of such species.

- *Cortón hirtus (L)*
- *Crotalaria sp. Por juncea L.*
- *Cassia tora (L)*
- *Cassia reticulata*
- *Hyptis capilata Jacq*
- *Hyptis atrorubens Poit*
- *Hyptis mutabiles*
- *Bactrix gasipaes*
- *Hibiscur sfarcelatus*
- *Crotalaria pilosa*
- *Corton trinitalis*
- *Senna occidentalis*

2.3.2 Preventive Measures

MIPE application calls for implementation of the following cultural crop activities, as indicated in Environmental Guideline No. 1:

- Seed beds and seedling nurseries management:

  → Seed beds require fertile earth and manure covering in 75% of the bed area.
  → Place 800 to 1,000 seeds per square meter
  → Seedlings are transplanted into 40 x 30 cm bags in a 50% shade covered area.
  → Growth stimulants should be applied at the humid base of the plant.

- Crop practices:

  → High density sowing
  → Use of fruit trees to provide shading to cacao crops, such as pawpaw, plantain and acacia.
  → Sowing should be done in square areas, 7x7 m or 8x8 m.
  → Diameter of hole should be 40 cm and 40 cm deep. Fill with a mixture of organic matter, manure and 50 grams of triple phosphate supplement.
  → 75% to 50% of the planning area should be cleared off alter the second year.
  → Use 50 grams of NPK and magnesium fertilizer mix.
  → Use triple mix fertilizer and magnesium mix plus decomposed manure applications three times a year, after the fourth year.
  → Prune sick branches twice a year
  → Affected material should be piled up and sprayed with Clorox or similar disinfectants, and burned.

- Manual weed control: This activity is recommended to protect beneficial insect hosting plants Use continuous control of weeds to project beneficial weed species. Recommended weed management activities include:

  → Initiate control at the weed growing phase, i.e. when plants have not reached maturity and roots have not formed completely.
  → *Plateo* (clearing and removing vegetal matter in a circular pattern around the plant base): The diameter of the circular area should be 1 m. *Plateo* should be done manually, roots may be contaminated by fungi harbouring in the stem produced by machete or similar tools inflicted wounds.
  → Keep weeds and other species off the circular cleared area. These absorb water and cacao nutrients. Fertilizer applied in *plateos* that have not been cleared off, will help weeds, not cacao trees.

  → Remove weeds in the spaces between trees with machetes or scythes.
  → Removed material can be used inside plantations to help in erosion control and act as water retainers.
  → Farm tools to be used: machetes, scythe and shovels

- Basic training for farmers on use of organic products producing neutral effects on air, flora and fauna in cacao crops (chicken manure, hydrolyzed protein pig manure, micorrizers, azotobacter, and phosphor).
- Technical assistance to farmers in application and management of organic products.
- Financial and logistic assistance to be rendered by coordinating and financial agencies to buy organic products to be used in cacao crops.
- Application of organic fertilizers , i.e. worm cultures as edaphic fertilizer in liquid form to be used as foliar fertilizer; solid organic fertilizer to be used as substrata and physical soil conditioner to conserve humidity.
- Use of worm humus from composts cells as describe in Environmental Guideline No. 6 may be done along with minor elements applied directly on the soil, such as potassium, magnesium and phosphor.

2.3.3 Corrective measures

Agrochemicals may be used in extreme situations only, after biological and cultural procedures are not sufficient to control pests and disease. Use Tordon for weed control. Fungicides such as copper oxichloride may be used in disease control. Entomophatogens, natural enemies of fungi, may be used.

3.0 Cost

The cost of MIPE will be charged to the project. UGA will be in charge of promotion and MIPE follow-up.

4.0 Responsibly parties:

Cacao Project implementing agencies, Technical Assistance Unit, Environmental Action Group, Environmental Agencies.

5.0 Chronogram

MIPE is a long-range activity that starts at the initiation of the Project (nursery and crop installation) and ends upon termination or abandonment of the Project.

6.0 MIPE Monitoring and Follow-up

Fol low-up includes verification of compliance with MIPE measures. Especially preventive measures. Inspection activities are included in Follow-up guidelines BT and HD in the Monitoring and Follow-up Plan.